

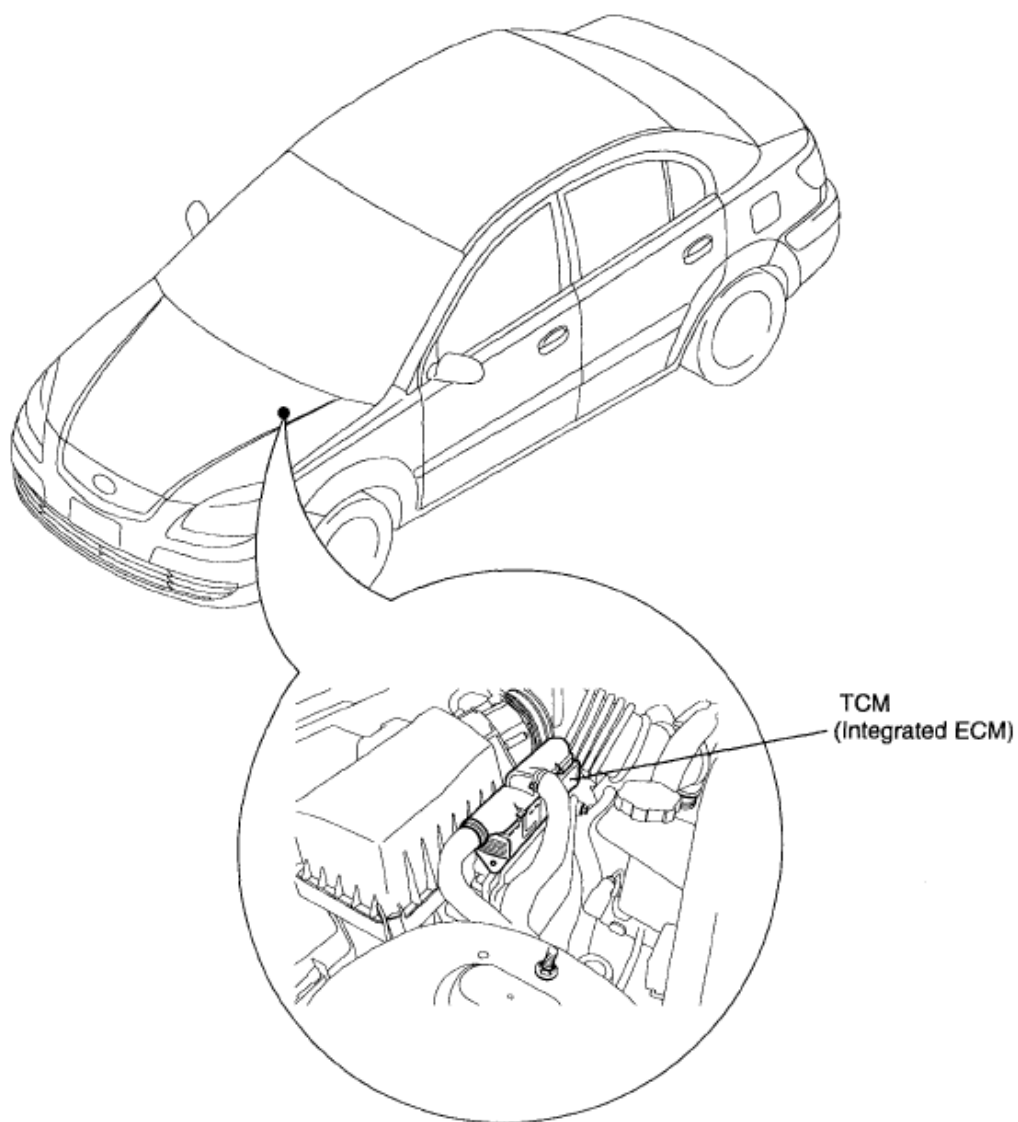
2006-07 TRANSMISSION**Automatic Transaxle System - Rio****DESCRIPTION**

The advanced alpha automatic transaxle is for a 1.6 DOHC engine. The advanced alpha AT is popularly used among small sized vehicles.

COMPONENTS

Nowadays PCM (power-train control module), which integrates the ECU and TCU inside, is new trend of the power-train system.

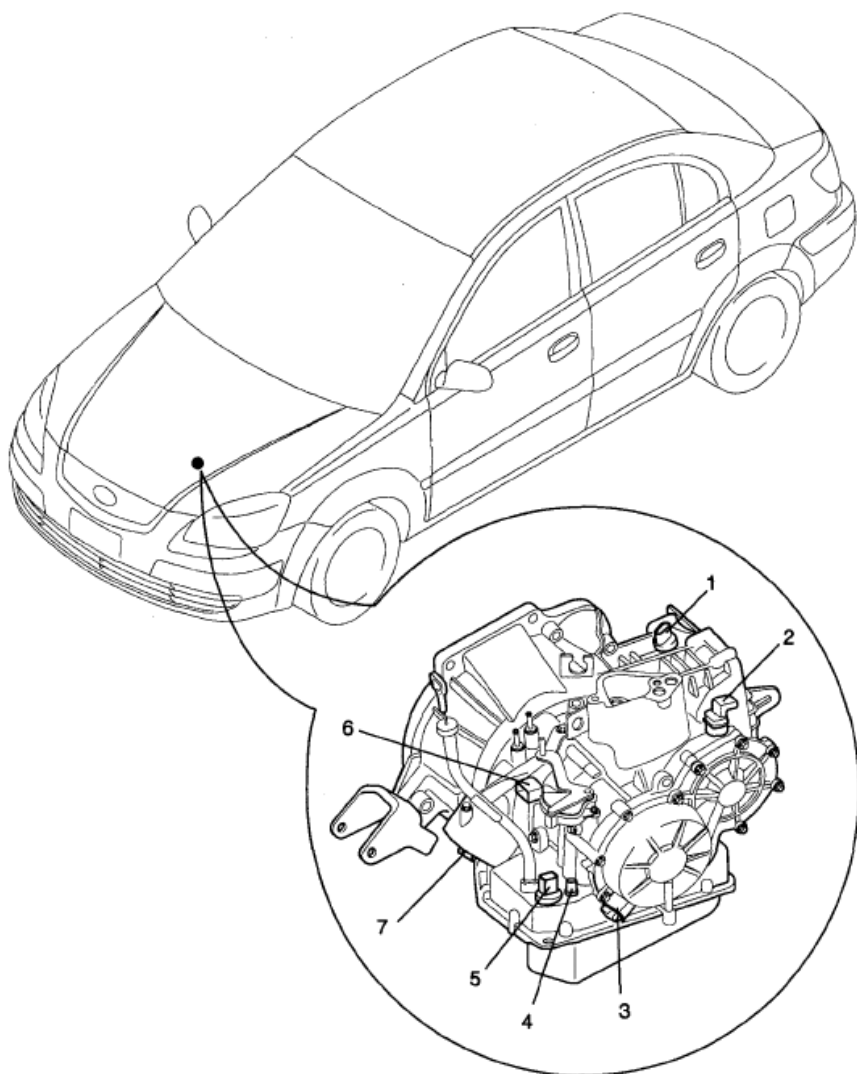
The merge of two system guarantees stable quality of the AT as well as better shift feeling and faster response to ECU information.



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Fig. 1: Locating TCM

Courtesy of KIA MOTORS AMERICA, INC.



- 1. Vehicle speed sensor
- 2. Output shaft speed sensor
- 3. Input shaft speed sensor
- 4. Fluid temperature sensor

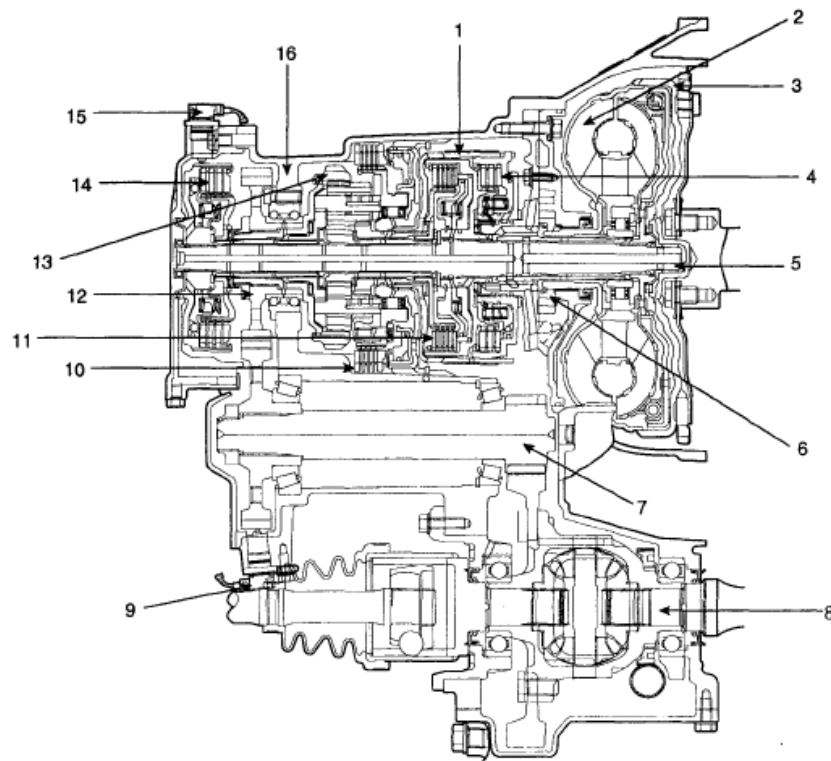
- 5. Solenoid valve
- 6. Inhibitor switch
- 7. Kickdown servo switch

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Fig. 2: Locating Transaxle
Courtesy of KIA MOTORS AMERICA, INC.

MECHANICAL SYSTEM

COMPONENTS



- | | |
|-------------------------|------------------------|
| 1. Kickdown band | 9. Pulse generator B |
| 2. Torque converter | 10. Low&Reverse brake |
| 3. Damper clutch | 11. Rear clutch |
| 4. Front clutch | 12. Output shaft |
| 5. Input shaft | 13. Planetary gear set |
| 6. Oil pump | 14. End clutch |
| 7. Transfer drive gear | 15. Pulse generator A |
| 8. Transfer driven gear | 16. Transaxle case |

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Fig. 3: Cutaway View Of Transaxle
Courtesy of KIA MOTORS AMERICA, INC.

FUNCTION

COMPONENTS FUNCTION CHART

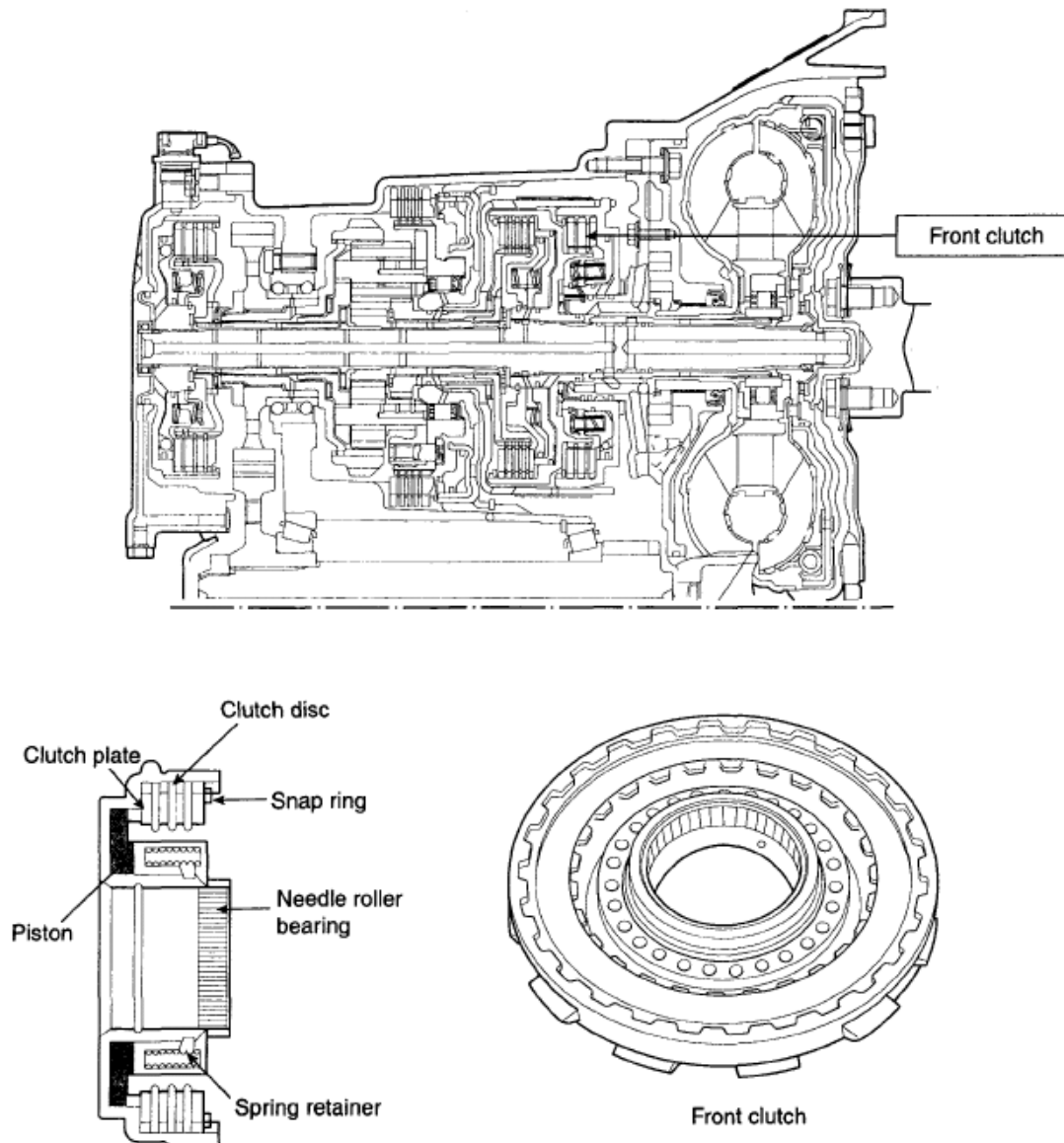
Component	Symbol	Function
Front clutch	F/C	Connect input shaft and reverse sun gear
Rear clutch	R/C	Connect input shaft and forward sun gear
End clutch	E/C	Connect input shaft and planetary carrier
Kick down brake	K/D	Hold reverse sun gear
Low & Reverse clutch	L/R	Hold planetary carrier
One way clutch	owe	Restrict planetary carrier turning direction

FRONT CLUTCH

Front clutch is engaged at 3rd gear of D range and R range. When it is engaged, reverse sun gear of the planetary gear rotates.

Power flow:

Input shaft--> Rear clutch retainer--> Front clutch--> Kick-down drum--> Reverse sun gear--> Long pinion--> Ring gear--> Transfer driven gear



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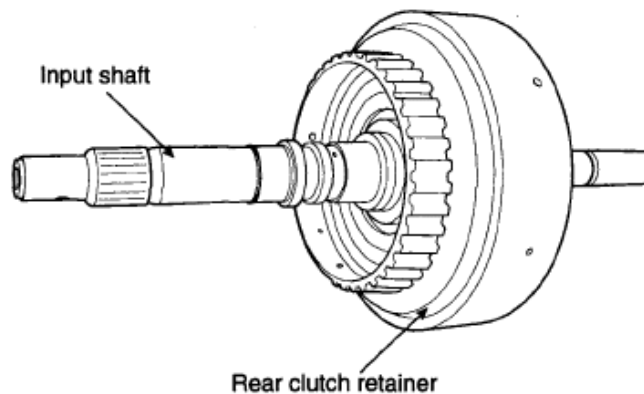
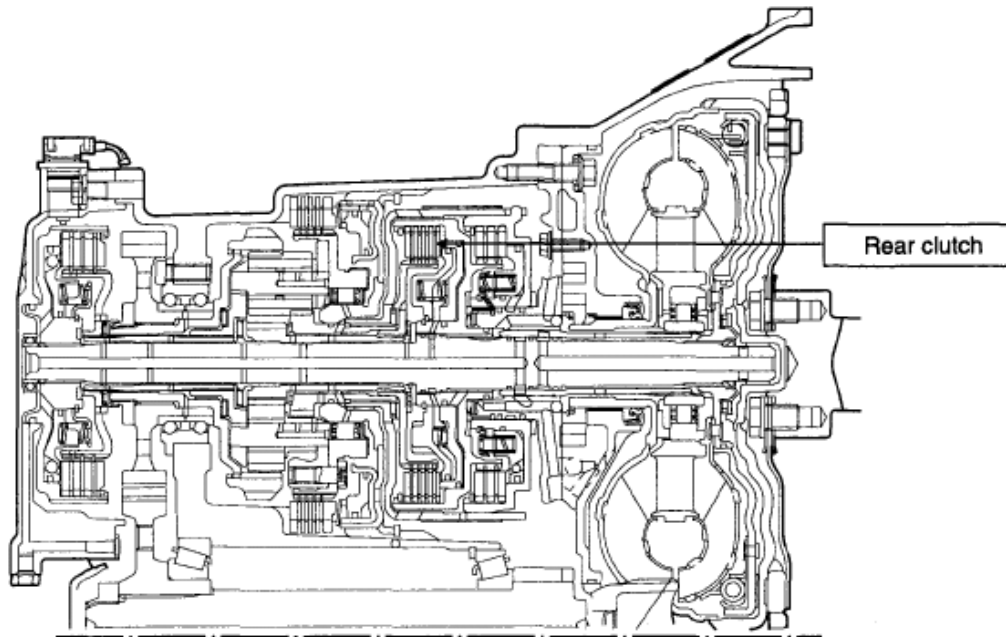
Fig. 4: Front Clutch Power Flow Diagram
Courtesy of KIA MOTORS AMERICA, INC.

REAR CLUTCH

Rear clutch is engaged at 1st~3rd gear of D/2/L range. When it is engaged, forward sun gear of the planetary gear rotates.

Power flow:

Input shaft--> Rear clutch retainer--> Rear clutch--> Rear clutch hub-> Forward sun gear--> Short pinion



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Fig. 5: Rear Clutch Power Flow Diagram
 Courtesy of KIA MOTORS AMERICA, INC.

END CLUTCH

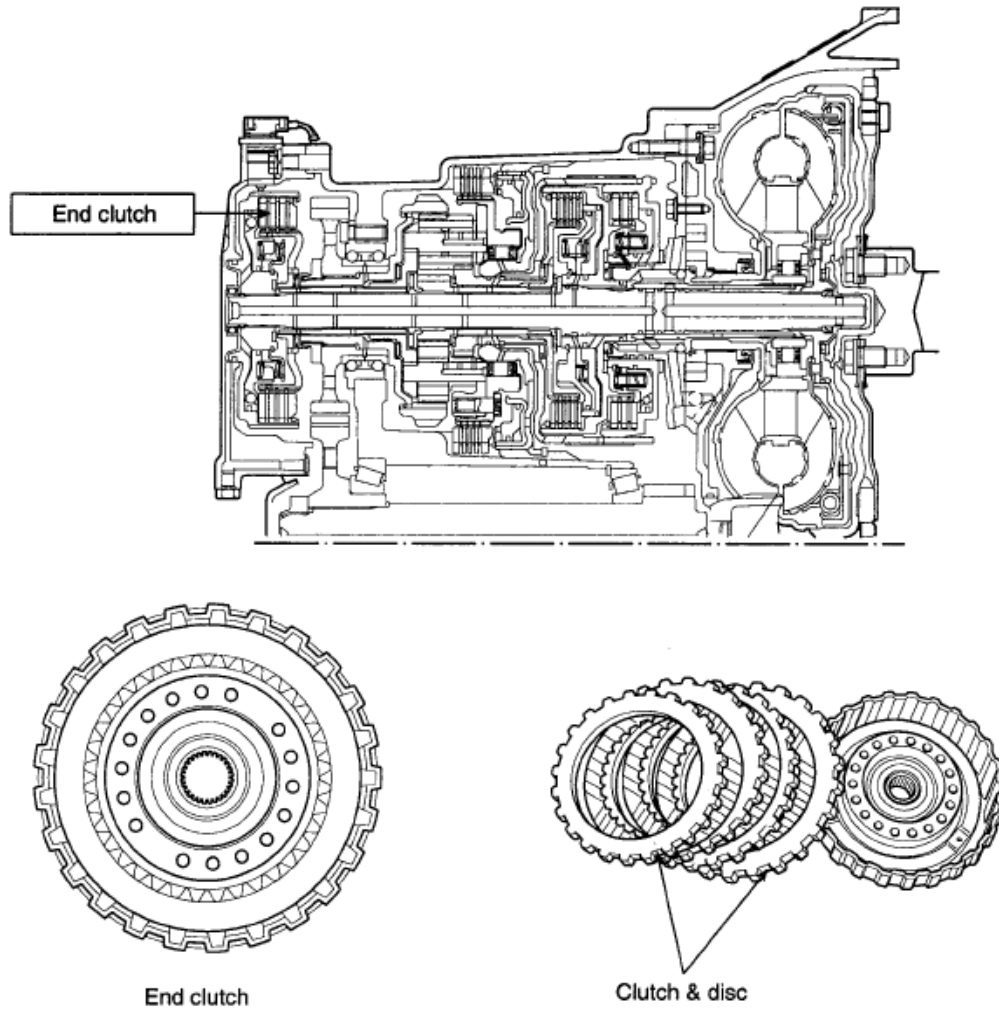
End clutch is engaged at 4th gear (Actually, end clutch is being engaged from 3rd gear.

This is only for smooth shifting to 4th gear).

When it operates, planetary carrier rotates.

Power flow:

Input shaft--> End clutch retainer--> End clutch--> End clutch hub--> End clutch shaft--> Planetary carrier --> Ring gear--> Transfer driven gear



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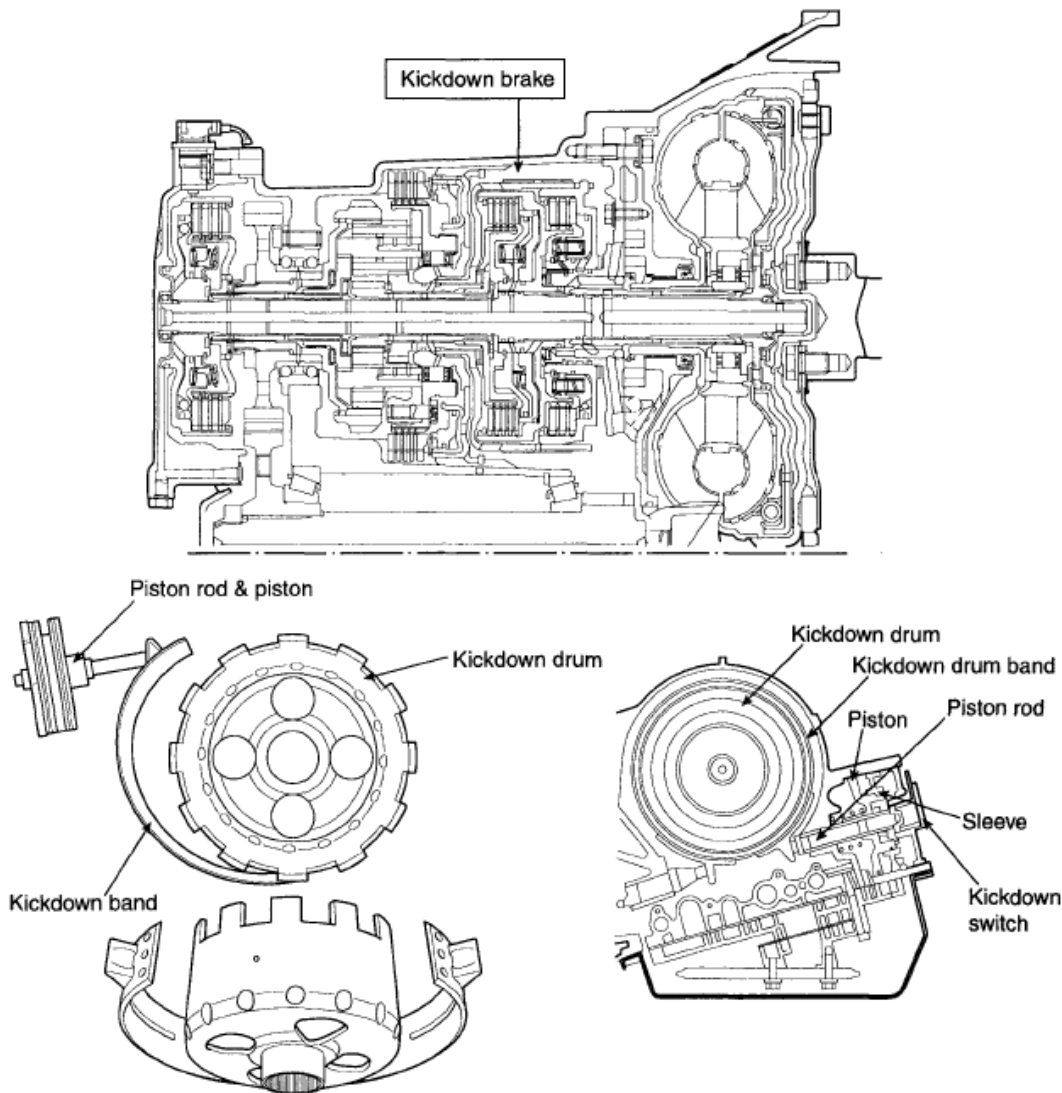
Fig. 6: End Clutch Power Flow Diagram
 Courtesy of KIA MOTORS AMERICA, INC.

KICK DOWN BRAKE

End clutch is composed of a kick down brake band, drum, servo piston and servo switch. It is engaged at 2nd & 4th gear. When it operates, reverse sun gear of the planetary gear is held.

Power flow:

Kick down brake--> Kick down drum hold--> Reverse sun gear hold



LKJF002E

Fig. 7: Kick Down Brake Power Flow Diagram
 Courtesy of KIA MOTORS AMERICA, INC.

The kickdown brake is a band type brake; it is composed of a kickdown band, drum, kickdown servo, switch and anchor. When the 2nd pressure is admitted to the apply side chamber of kickdown servo cylinder, the kickdown piston and rod moves toward the left, tightening the brake band to hold the kickdown drum. As a result, the reverse sun gear (interlocked with the kickdown drum) is held. This brake functions during 2nd gear and during overdrive. The kickdown servo switch detects the position of the kickdown piston just before the brake is applied, and sends the signal to the transaxle control module. Using this signal, the transaxle control module controls the 2nd pressure both before, and during application of the brake. In the initial control stage or until just before the kickdown brake is applied, a higher 2nd pressure is supplied to the kickdown servo so that the kickdown piston can move quickly for faster response to the kickdown condition that has been initiated. In the second control stage or while the brake is being applied, the 2nd pressure is regulated at an optimum level so that the band is tightened on the drum the proper amount for good kickdown "feeling".

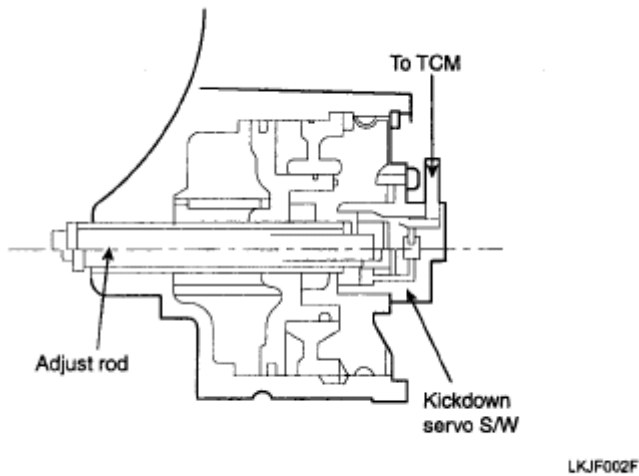


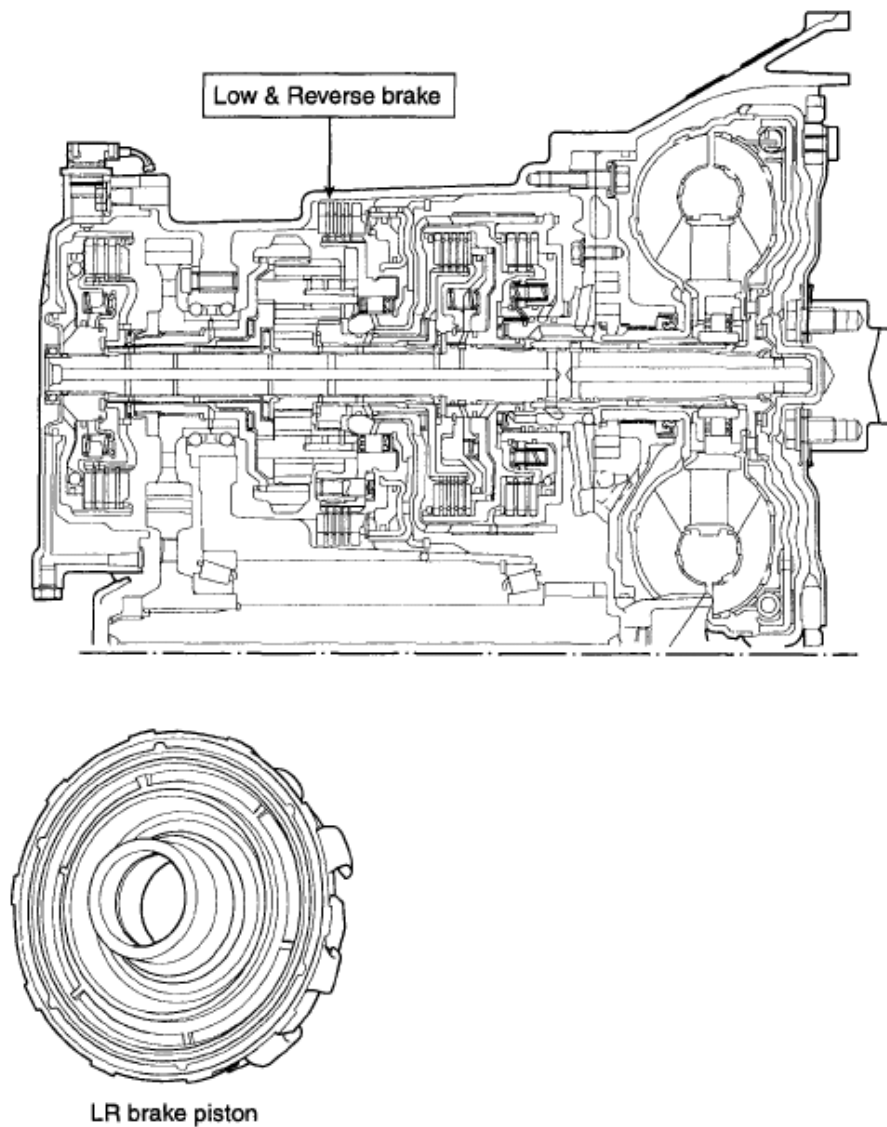
Fig. 8: Applying Side Chamber Of Kickdown Servo Cylinder Kickdown Piston And Rod Moves
 Courtesy of KIA MOTORS AMERICA, INC.

LOW & REVERSE BRAKE

Low & Reverse brake is engaged at 1st gear of L range and R range. When it operates, the planetary carrier is held.

Power flow:

Low & Reverse brake--> Planetary carrier hold



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Fig. 9: Low & Reverse Brake Power Flow Diagram
Courtesy of KIA MOTORS AMERICA, INC.

Low & reverse brake is of the multiple disc type and is composed of a center support, disc plates and a piston. The brake operates when the shift is in 1st gear in the "L" range or back gear. It fastens the carrier in the planetary gearing set. That is, the shafts of the long and short pinions are fastened.

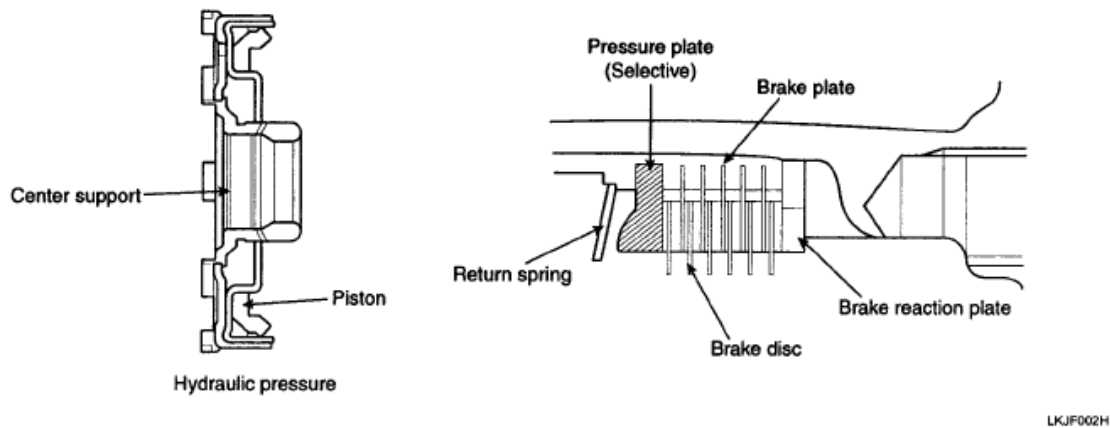
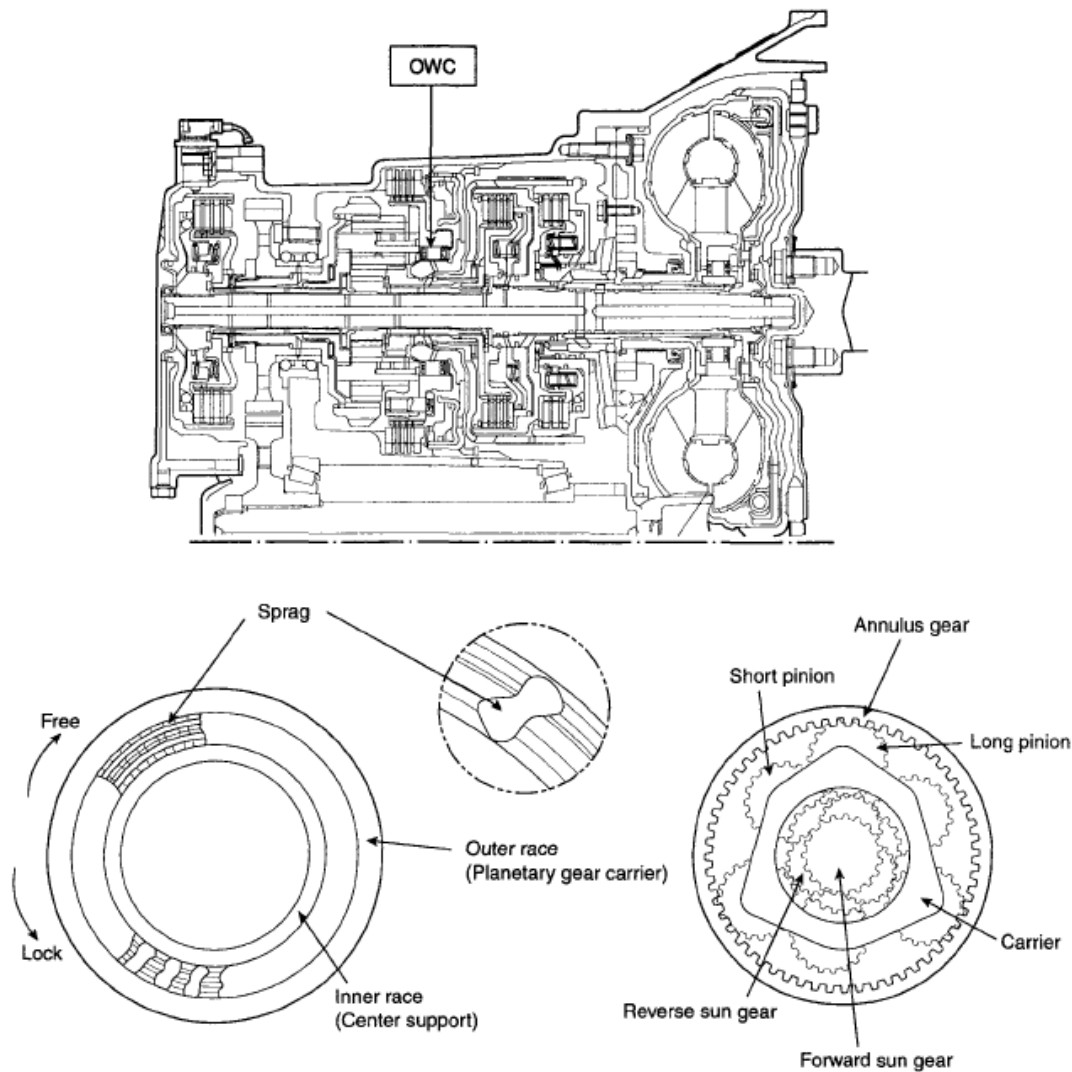


Fig. 10: Identifying Center Support And Piston
 Courtesy of KIA MOTORS AMERICA, INC.

ONE WAY CLUTCH (O.W.C)

One-way clutch is of the sprag type and is incorporated between the pinion carrier and the center support.

In 1st gear (D or 2 range), the long pinion rotates clockwise. This reduces a force which has the tendency to cause the carrier is blocked from rotating in that direction by the one-way clutch. As a result, the long pinion transmits its force to the annulus gear. The carrier, which is coupled with the one-way clutch outer race, is free to turn in clockwise direction. In an engine braking condition under which the annulus gear is turned first, the carrier turns clockwise freely and, therefore, the engine braking effect is not obtained.



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Fig. 11: Rotating In Direction By One-Way Clutch
 Courtesy of KIA MOTORS AMERICA, INC.

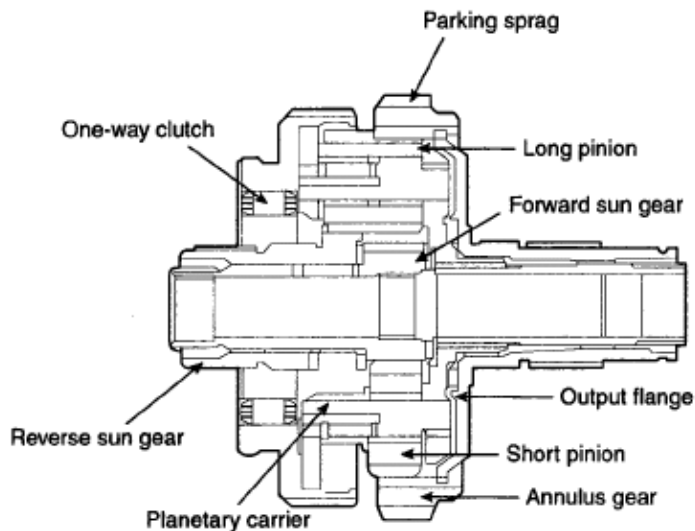
PLANETARY GEAR

The planetary gear set incorporated in this transaxle consists of a forward sun gear, a reverse sun gear, a short pinion, a carrier to support both pinions, and an annulus gear.

The reverse sun gear is connected to the front clutch retainer via the kickdown drum, while the forward sun gear is connected to the rear clutch hub.

The carrier is built in one unit with the low reverse brake's hub and the outer race of the one-way clutch. The carrier is connected to the end clutch via the end clutch shaft. The annulus gear, to which the output flange is connected, conveys driving force to the transfer drive gear installed on the output flange. And the parking sprag is provided on the outer circumference of the annulus gear.

The Ravigneaux type planetary gear set consists of two sun gears, each meshing with one of two sets of planetary pinion gears in a single carrier, and a single annulus gear that meshes with one of the sets of pinions. The two sun gears are called the forward and the reverse sun gears, for the gear conditions they operate in. Power input is to either of these two sun gears. Power output is through the annulus gear, which has the parking sprag on the outer circumference. Various holding elements are built into gear set components.- Ravigneaux type planetary gear ratio.



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Fig. 12: Identifying Planetary Gear Components Location
Courtesy of KIA MOTORS AMERICA, INC.

PARKING MECHANISM

When the shaft is in the "P" range, the parking pawl engages with the parking sprag provided on outer circumference of the annulus gear to fasten the output shaft, to prevent the wheels from rotating. In other words, when the select lever is set to the "P" range, the detent plate and the parking sprag rod move in the direction of arrow, causing the cam on the parking sprag rod to push up the parking pawl to engage with the sprag.

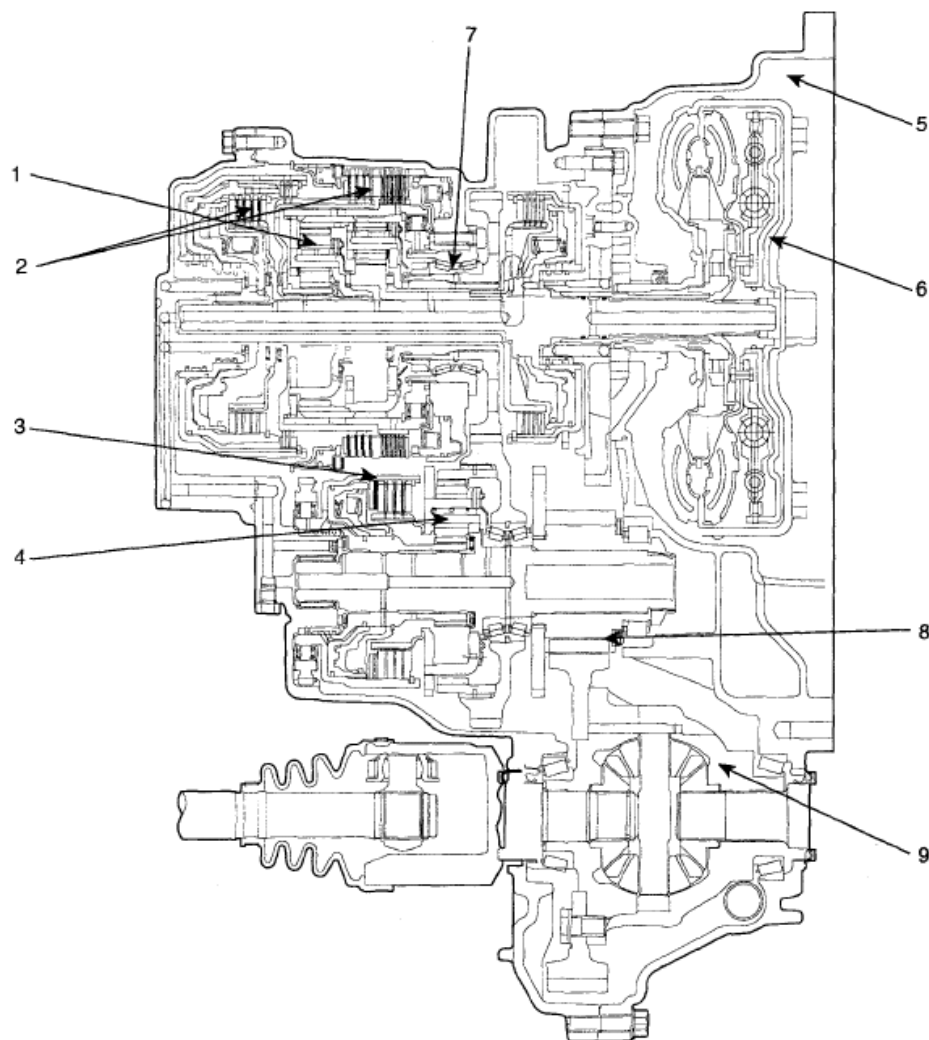
In case the parking pawl collides against a crest of the sprag, only the rod moves because the parking pawl cannot be moved upward, and the cam, while pressing the spring, collides with the parking pawl and the support, and is with held in this condition. If the car is moved even slightly in this condition, the turning of wheels causes the annulus gear to turn as well. Since the cam is pressed in the direction of arrow, the parking pawl is pushed up as a bottom of the sprag aligns with the parking sprag to engage with the sprag.

In this way, the parking mechanism eliminates any chances of the vehicle from being.

SYMPTOM CHART

No.	Cause	Symptom	Analysis	Remedy
1	Locking due to cam broken	Forward and / or reverse drive impossible intermittently	Parking sprag locks the annulus gear due to drifted cam	Replace parking sprag rod

2	Detent ball separated	Looseness of manual lever	Detent plate not fixed properly	Install detent ball
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1. Overdrive planetary gear (3→4 pinions)
2. SSP(Single sided plate)
-Overdrive clutch
-2ND brake
3. Reduction band (Piston increased)
4. Direct planetary gear (3→4 pinions)

5. Case/ Housing intensity reinforced & redesigned
6. High capacity torque converter
7. Bearing outer diameter increased (Φ5 mm)
8. Differential gear (Increased width by 2mm)
9. Differential capacity increased (6.1→7)

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Fig. 13: Identifying Parking Mechanism Components Location
Courtesy of KIA MOTORS AMERICA, INC.

POWER FLOW

SELECTOR LEVER POSITION - POWER FLOW CHART

Selector lever position	Gear position	Clutches			Brakes			Re- marks
		F/C	R/C	E/C	K/D	L&R	OWC	

2006 Kia Rio

2006-07 TRANSMISSION Automatic Transaxle System - Rio

P			Parking						* []
R			Reverse	o			o		
N			Neutral						*
D	O/D S/W ON	O/D S/W OFF	1st		o			o	
			2nd		o		o		
			3rd	o	o	delta			
			4th			o	o		
2			1st		o			o	
			2nd		o		o		
L			1st		o		o		

* - Engine start possible

[] - Parking mechanism

o - Element engaged in each gear position

delta - Pre-engaged element

- F/C: Front Clutch
- R/C: Rear Clutch
- E/C: End Clutch
- OWC: One Way Clutch
- K/D: Kickdown brake
- L&R: Low & Reverse brake

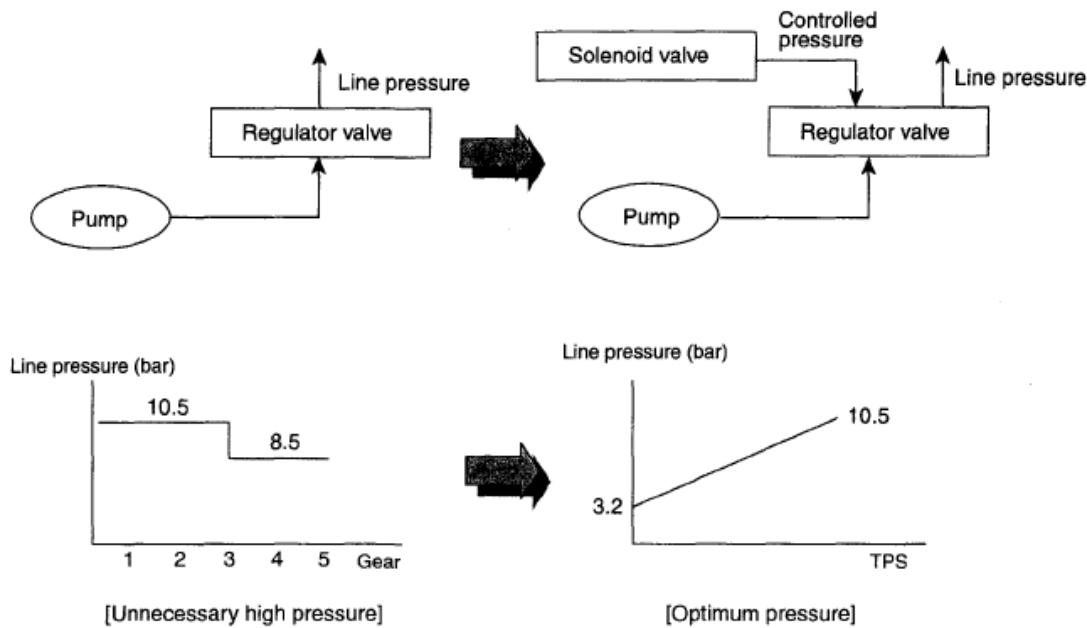
For each shift condition, certain holding units in the transaxle are used. Knowing which holding element is used and how they are connected in the transaxle, we can trace the power flow through the transaxle for each shift condition. One set of pinions, the short pinions, meshes with the reverse sun gear.

The other set, the long pinions, meshes with both the forward sun gear and with the annulus gear. The two sets of pinions also mesh with each other in pairs. The pinion carrier is built as a unit with the low reverse brake hub and the outer race of the one-way clutch. Power input is to either of the two sun gears.

The reverse sun gear is connected to the front clutch retainer through the kick-down drum. The forward sun gear is connected to the rear clutch hub. So by engaging either the front or the rear clutch, power is directed to either the reverse or the forward sun gear. When both front and rear clutches are engaged, the gear set is locked, and power passes directly through the transaxle. Power output is through the annulus gear, which has the parking sprag on the outer circumference and is connected to the output flange.

1ST GEAR ("D" AND "2" RANGE)

Operating elements: Rear Clutch, One-Way Clutch

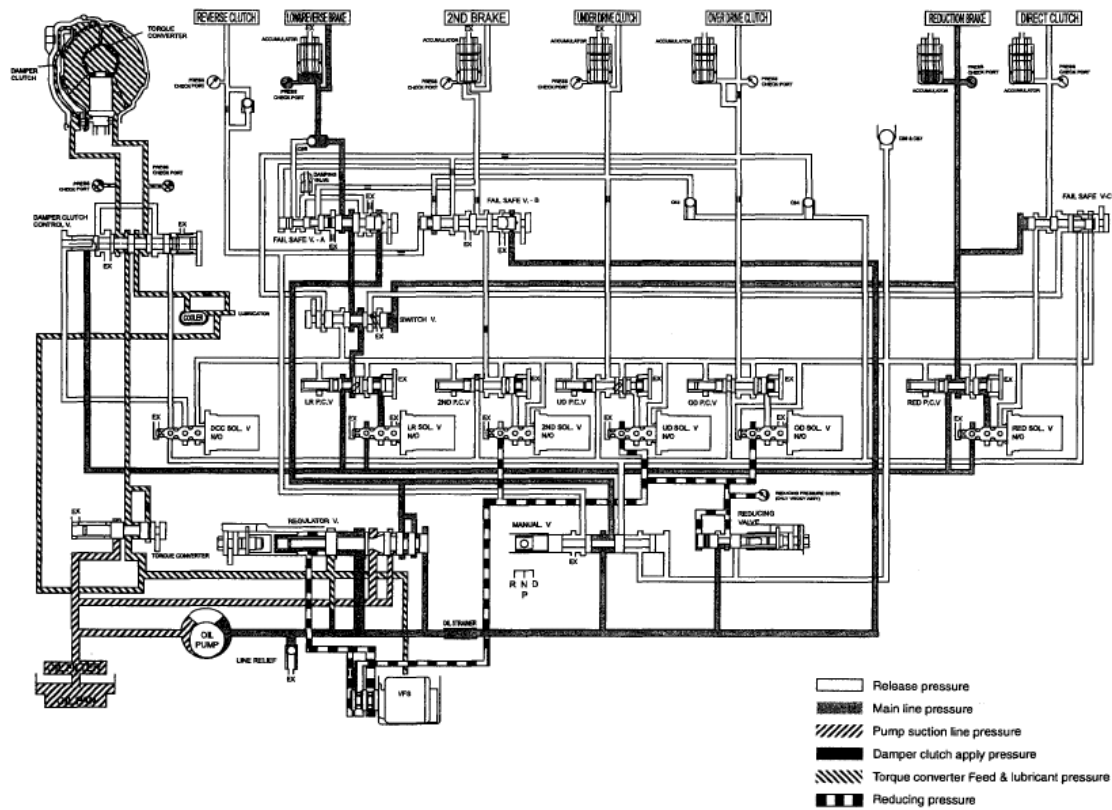


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Fig. 14: 1St Gear "D" And "2" Range - Rear Clutch, One-Way Clutch Operation
 Courtesy of KIA MOTORS AMERICA, INC.

1ST GEAR ("L" RANGE)

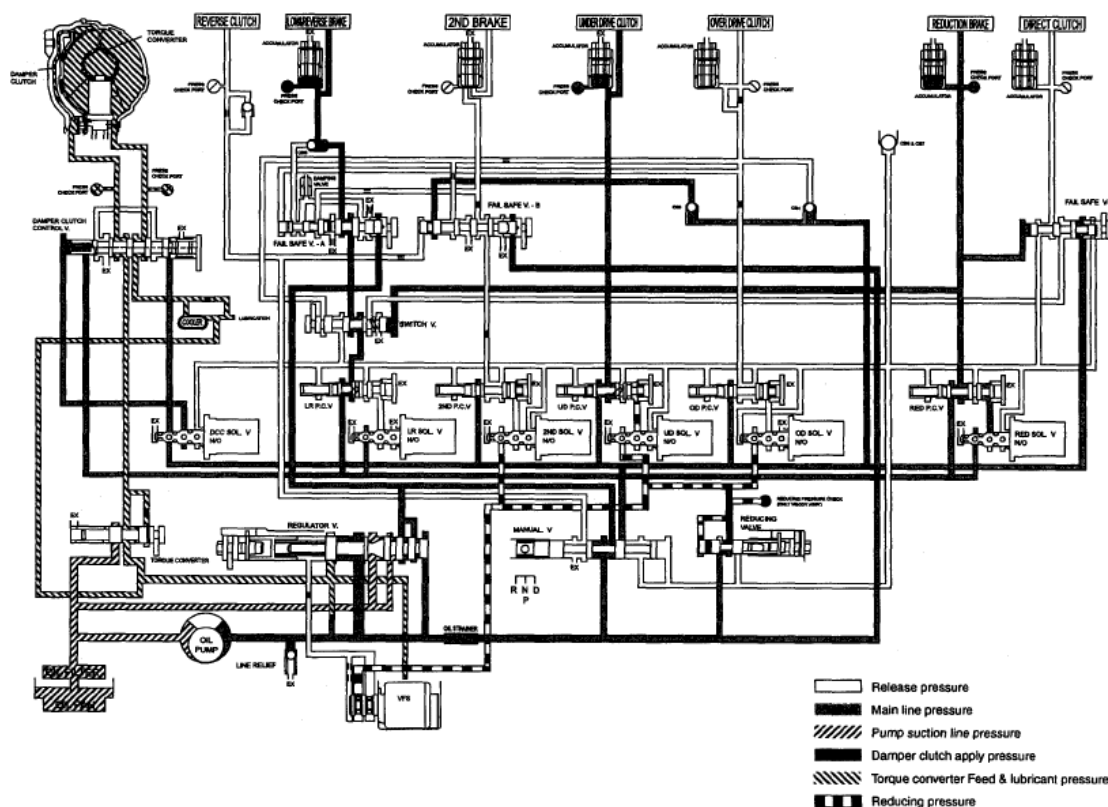
Operating elements: Rear Clutch, Low & Reverse Brake



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Fig. 15: 1st Gear "D" "L" & 2nd Range - Rear Clutch, Low & Reverse Brake Operation
 Courtesy of KIA MOTORS AMERICA, INC.

2ND GEAR ("D" AND "2" RANGE)

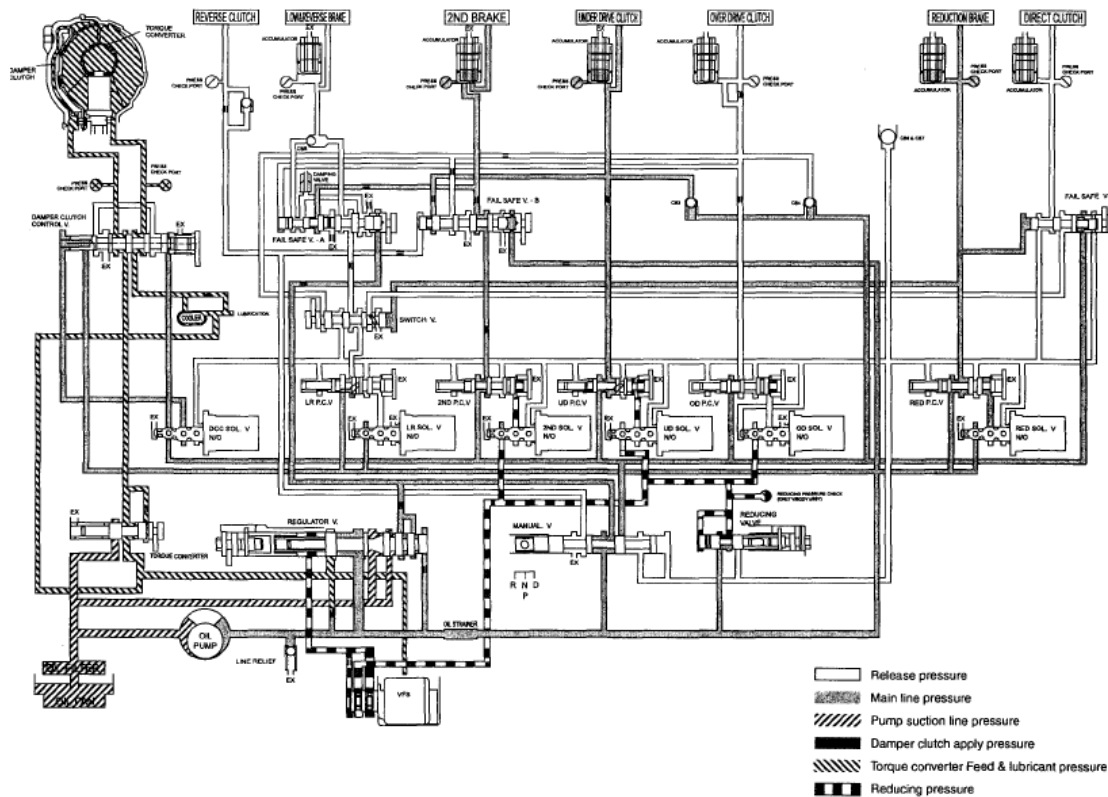


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Fig. 16: 2nd Gear ("D" And "2" Range - Rear Clutch Kick Down Brake Operation
 Courtesy of KIA MOTORS AMERICA, INC.

3RD GEAR ("D" RANGE)

Operating elements: Front Clutch, Rear Clutch, End Clutch

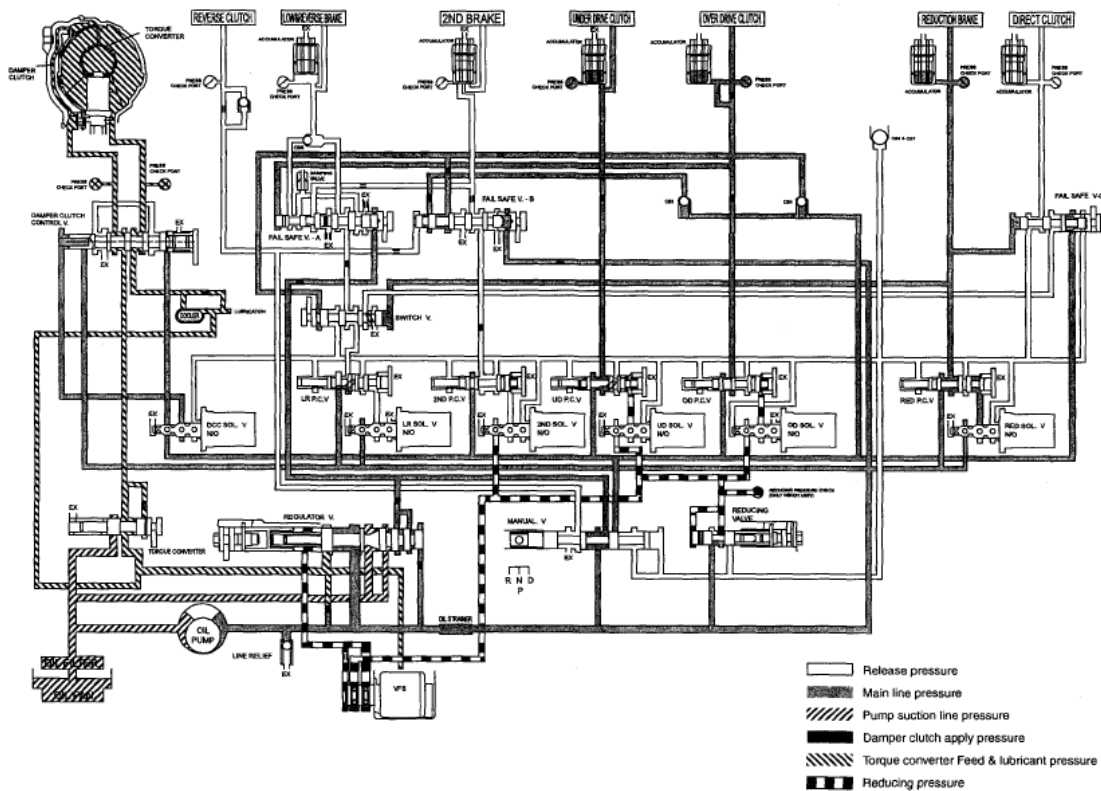


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Fig. 17: 3rd Gear "D" Range - Front Clutch, Rear Clutch, End Clutch Operation
 Courtesy of KIA MOTORS AMERICA, INC.

4TH GEAR ("D" RANGE)

Operating elements: Front Clutch, Rear Clutch, End Clutch



EKB004D

Fig. 18: 4th Gear "D" Range - Front Clutch, Rear Clutch End Clutch Operation
 Courtesy of KIA MOTORS AMERICA, INC.

"R" RANGE

Operating elements: Front Clutch, Low & Reverse Brake



HYDRAULIC CONTROL SYSTEM

1. The hydraulic pressure during gear shifting engages the clutches and applies the brakes. It is regulated by the pressure control valve. The hydraulic pressure that works on the pressure control valve is further regulated by the pressure control solenoid valve which functions under the control of the transaxle control module. The transaxle control module controls the solenoid valve using a duty cycle signal, thus providing appropriate regulation of the hydraulic pressure.
2. The transaxle control module decides the timing of the gear-shifting period (during which it performs hydraulic pressure control for gear shifting) according to the change in the kickdown drum rotating speed that it detects. The module identifies the time just before the kickdown brake is applied and uses that as the timing for initiating control of the hydraulic pressure that is to be applied to the kickdown brake.
3. TCM detects torque change ratio (turbine speed change ratio in torque converter). If input torque is larger than the pre-set torque in TCM, TCM controls the duty of PCSV and changes oil pressure. Shift shock will be alleviated due to torque control. Torque change ratio is applied differently according to each pattern.
4. When the transaxle is cold, the fluid viscosity is high, causing slower oil pressure response. In such conditions, the transaxle control module provides a correction for the oil pressure by changing the control duty of the pressure control solenoid valve. This control is performed when the fluid temperature as indicated by the oil temperature sensor is lower than 60°C (140°F).
5. After the engine has been started and the vehicle is in motion, the transaxle control module continues to

refine its performance for smoothest possible gear shifting.

The hydraulic control system consists of an oil pump that generates hydraulic pressure for A/T. It also has valves and solenoid valves that control the hydraulic pressure or switch the oil passage. The valves and solenoid valves are all built into the valve body. For better and smoother shift quality, the rear clutch pressure is controlled independently, 4th-->2nd gear skip shift is available and the line pressure at 3rd/4th gear is reduced.

There are 6 solenoid valves are incorporated on the valve body. 2 of those are duty-controlled type and the rest are ON/OFF type.

- Duty control type: Pressure control solenoid valve A/B, Damper clutch control solenoid valve
- ON/OFF type: Shift control solenoid valve A/B/C

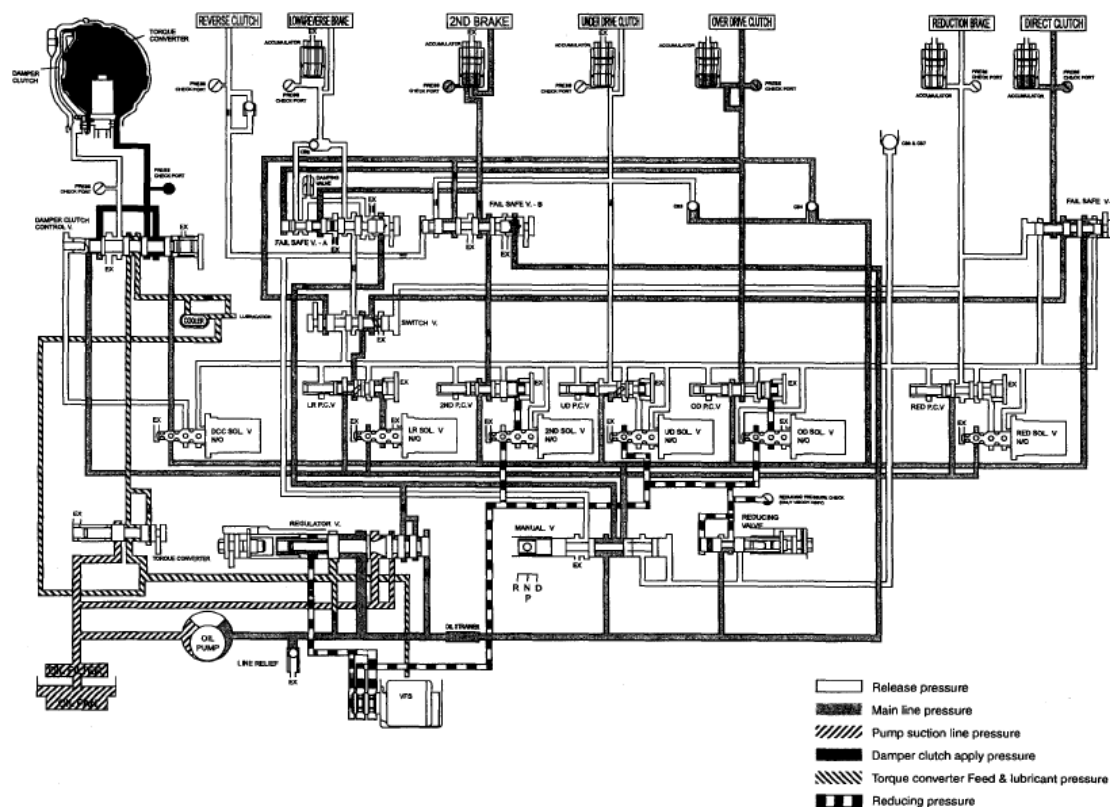
If the mechanical malfunction such as valve sticking occurred, the fail-safe valve has been adopted to prevent interlock. The line pressure is regulated at the 4th speed to improve the efficiency of power transmission. This function is performed by High-low pressure valve and regulator valve.

OIL PUMP

Oil pump generates pressure for supplying oil to the torque converter, for lubricating frictional parts of the planetary gearing set and the overrunning clutch, etc., and for activating the hydraulic control system.

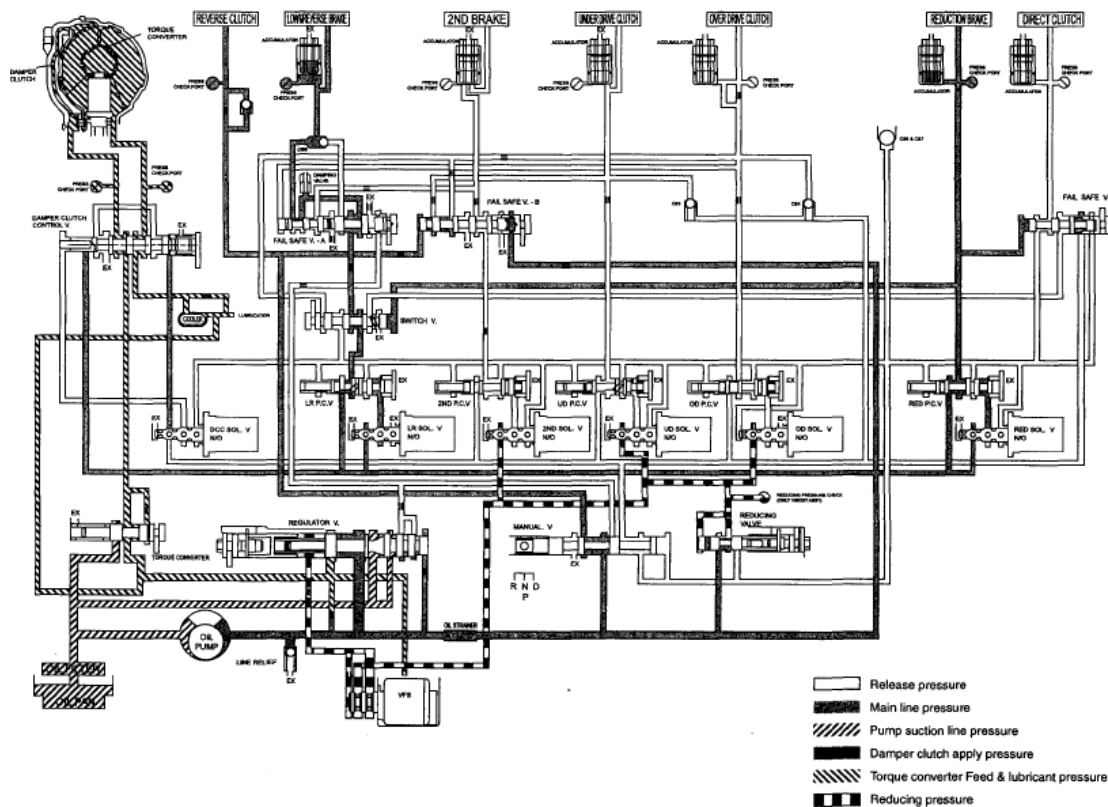
The pump is one of the inner-teeth engaging trochoid type. It always generates the oil pressure when the engine is running since the drive gear is driven by 2 pawls of the pump drive hub welded at the center of the torque converter shell.

MANUAL VALVE



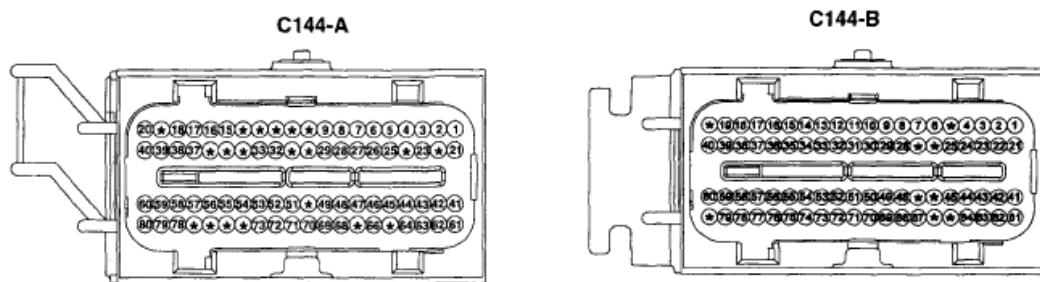
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Fig. 20: Manual Valve Operation Diagram - (D) Range
 Courtesy of KIA MOTORS AMERICA, INC.



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Fig. 21: Manual Valve Operation Diagram - (P) Range
Courtesy of KIA MOTORS AMERICA, INC.



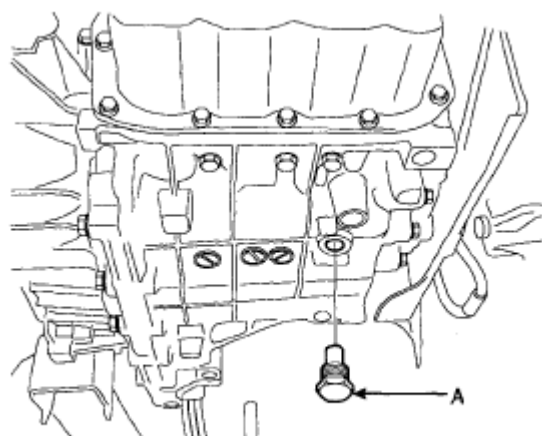
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Fig. 22: Manual Valve Operation Diagram - (N) Range
Courtesy of KIA MOTORS AMERICA, INC.

PRESSURE CONTROL VALVE-A, B

Pressure control valve A, B regulate the pressure supplied to each clutch under the control of the pressure control solenoid valve A, B to eliminate shock at the time of shifting.

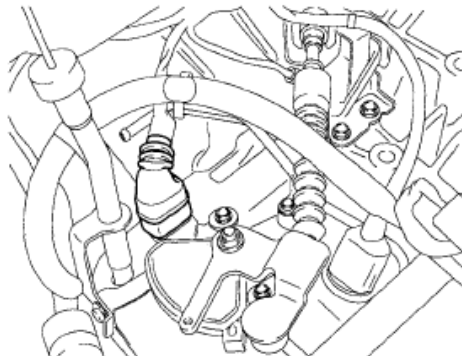
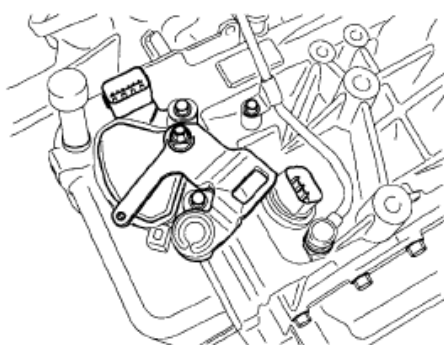
1. Pressure control valve A - Not operated



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Fig. 23: Pressure Control Valve A - Not Operated
 Courtesy of KIA MOTORS AMERICA, INC.

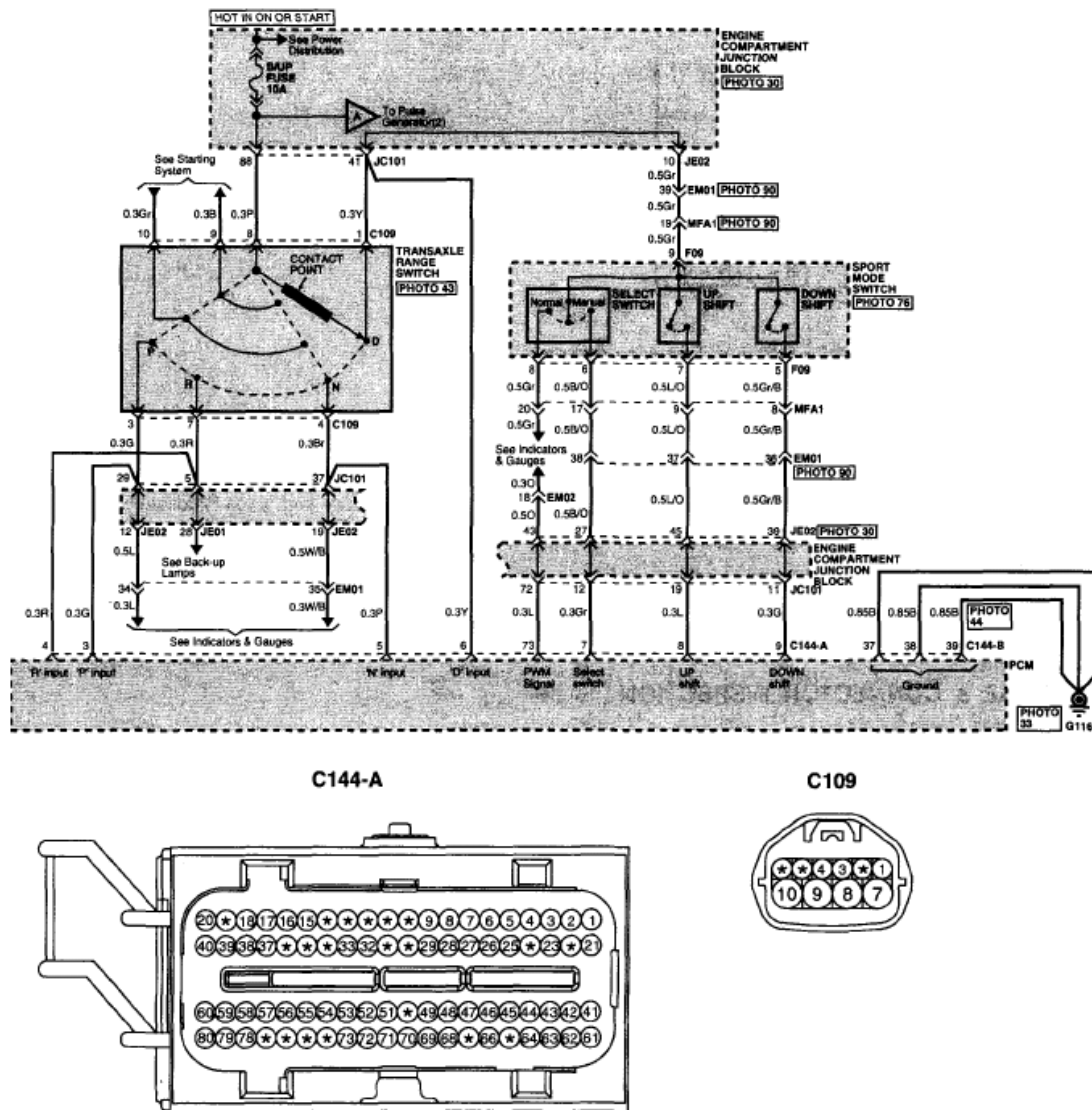
1. Pressure control valve A - Operation



KKCF200A

Fig. 24: Pressure Control Valve A - Operation
 Courtesy of KIA MOTORS AMERICA, INC.

1. Pressure control valve B - Not Operated



EKB F100E

Fig. 25: Pressure Control Valve B - Not Operated
Courtesy of KIA MOTORS AMERICA, INC.

1. Pressure control valve B - Operation

The main function of this valve controls the rear clutch independently.

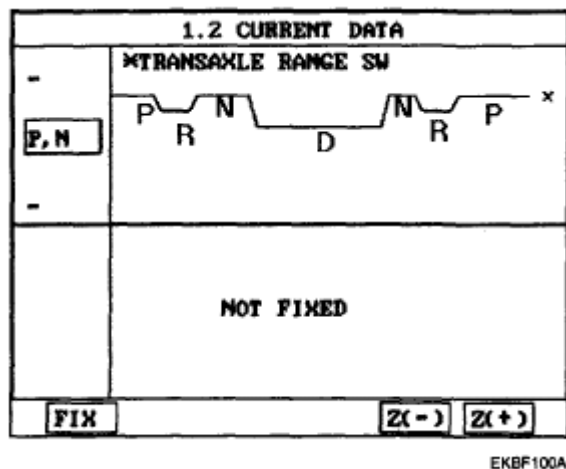


Fig. 26: Pressure Control Valve B - Operation
 Courtesy of KIA MOTORS AMERICA, INC.

SHIFT CONTROL VALVE (SCV) AND SOLENOID VALVE-A, B, C (SCSV-A, B, C)

The line pressure acting upon the shift control valve is controlled by the two shift control solenoid valves (which are switch ON and OFF according to the shifting gear by the transaxle control module command), and the shift control valve is activated according to the shifting gear, thus switching the oil passages.

The relationship of the shifting gear and the ON-OFF switch of shift control solenoid valve "A", "B" and "C" is shown in the table below.

SHIFT CONTROL SOLENOID VALVE OPERATION

Operation Position	Shift control solenoid valve		
	A	B	C
1st gear	ON	ON	OFF
2nd gear	OFF	ON	OFF
3rd gear	OFF	OFF	ON
4th gear	ON	OFF	ON

CONTROL SWITCH VALVE (CSV) & END CLUTCH (E/C) VALVE

○ Function

Switching the pressure of E/C and SA

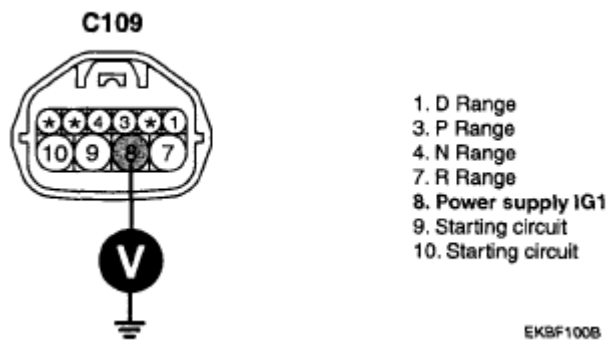


Fig. 27: Control Switch Valve Function Diagram
Courtesy of KIA MOTORS AMERICA, INC.

- 2nd Gear
 - 2nd pressure is supplied from SA through the CSV.
 - SCSV-C maintains OFF as well as 2nd gear.

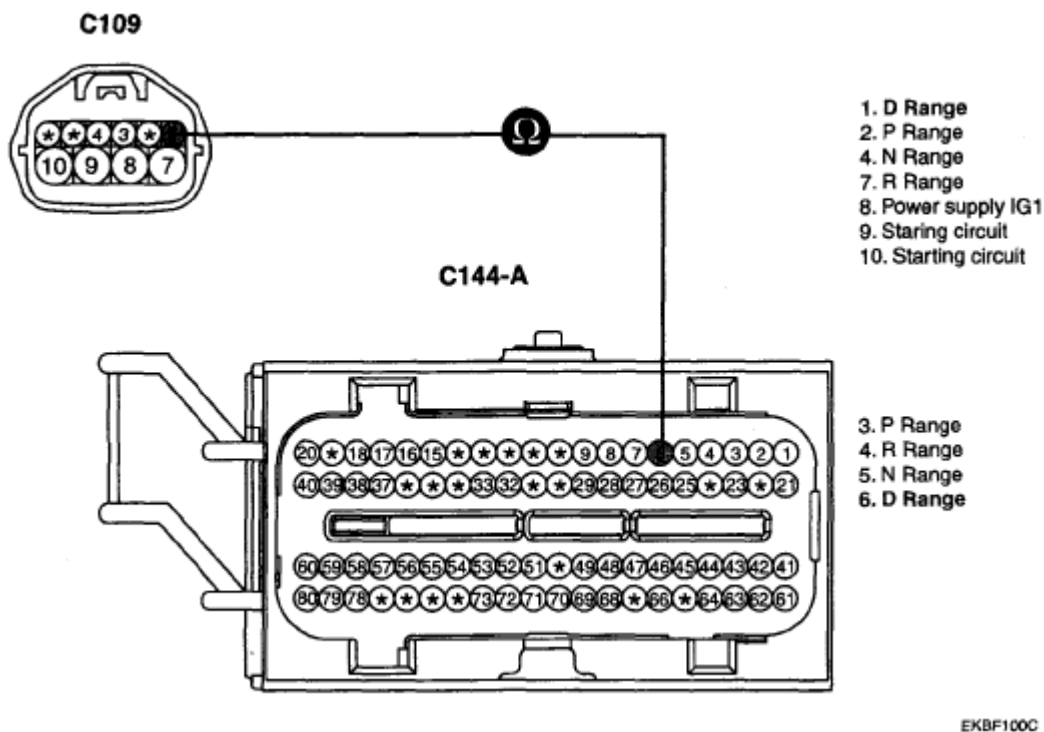
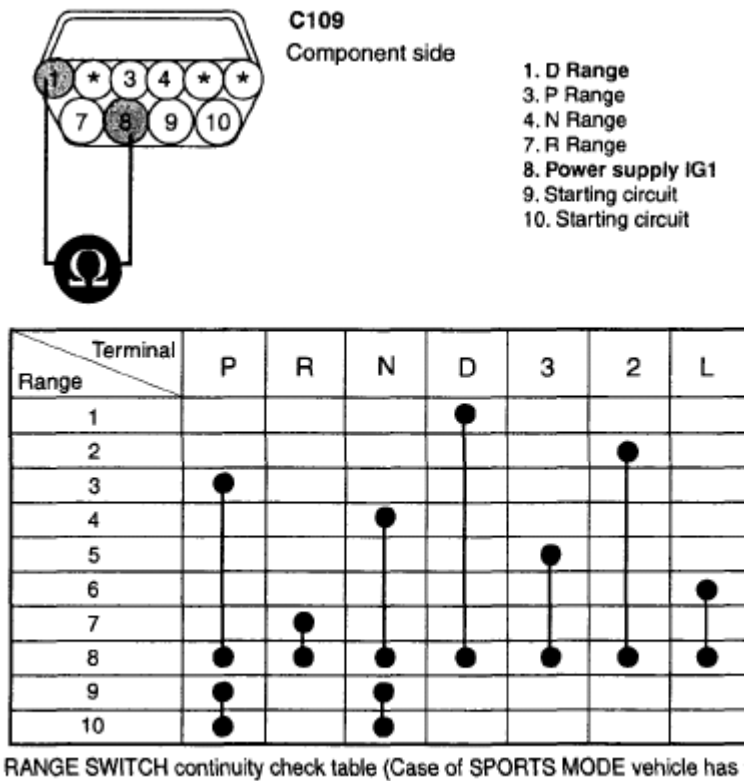


Fig. 28: Control Switch Valve (2Nd Gear) Function Diagram
Courtesy of KIA MOTORS AMERICA, INC.

- 2nd --> 3rd gear
 - SCSV-C maintains OFF as well as 2nd gear.
 - The E/C pressure from shift control valve is intercepted at the E/C valve during up-shifting from 2nd to 3rd gear.
 - SA pressure is supplied from 1-2 shift valve, but the front clutch and SR pressure is also supplied

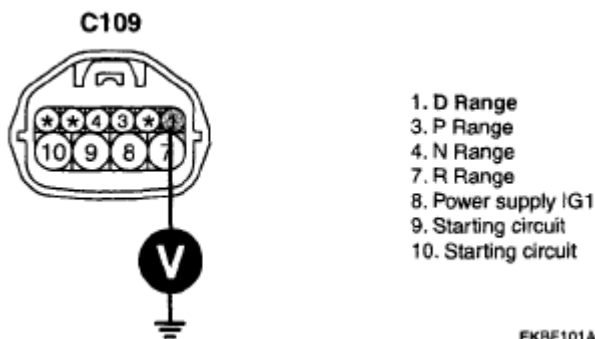
from the 2-3/4-3 shift valve, so the both SR and SA pressure will be set off..



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Fig. 29: Control Switch Valve (2nd And 3rd Gear) Function Diagram
Courtesy of KIA MOTORS AMERICA, INC.

- 3rd gear
 - SCSV-C is changed from OFF to ON.
 - The E/C pressure is supplied from 1-2 shift valve at the CSV after finishing the up-shifting from 2nd to 3rd gear.
 - SA pressure is supplied from shift control valve, but the front clutch and SR pressure is also supplied from the 2-3/4-3shift valve, so the both SR and SA pressure will be set off.



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Fig. 30: Control Switch Valve (3Rd Gear) Function Diagram

Courtesy of KIA MOTORS AMERICA, INC.

4 --> 2 SKIP SHIFT

1. Operating elements

SPEED REFERENCE CHART

Speed	R/C	E/C	K/D
4th	-	o	o
2nd	o	-	o

2. Controls

- R/C engaging duty control
- E/C releasing duty control
- Continuous switching to SA

3. Description

- R/C engaging duty control

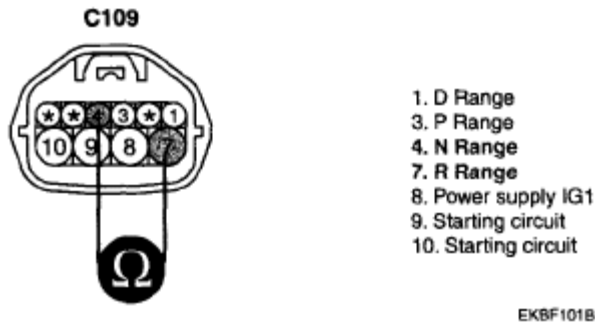


Fig. 31: Gear Shift Operation Diagram - R/C Engaging
Courtesy of KIA MOTORS AMERICA, INC.

- E/C releasing duty control

4-->2 Skip shift only (SCSV-C ON)

When releasing the E/C clutch pressure, it is controlled by duty of PCSV-A only in case of 4 --> 2 skip shift.

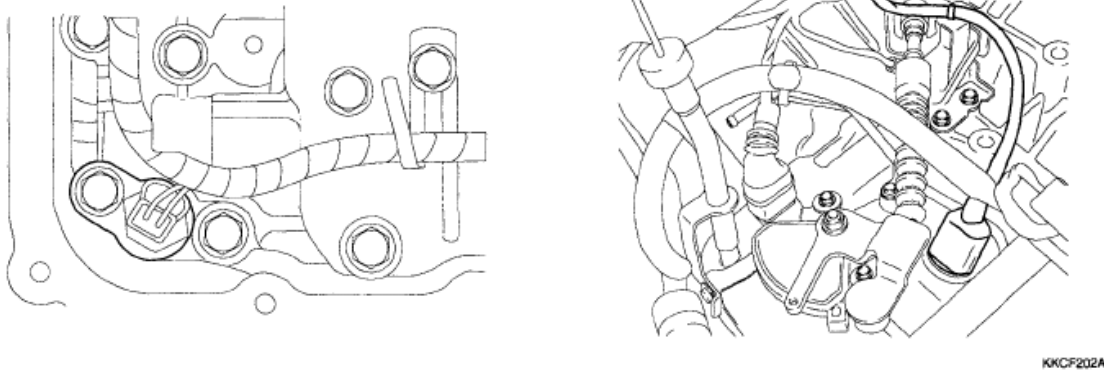


Fig. 32: Gear Shift Operation Diagram - E/C Releasing
 Courtesy of KIA MOTORS AMERICA, INC.

- c. Continuous switching to SA

From (SCV) to SA through (CSV)

FAIL SAFE FUNCTION

1. TCM malfunction in 1st or 2nd gear.

CUTTING OFF THE E/C PRESSURE BY E/C VALVE

SPEED REFERENCE CHART

Speed	F/C	R/C	E/C	K/D
1st		o		
2nd		o		o
Fail	o	o		

- o F/C, SR: from 2-3/4-3 shift valve
- o R/C: from PCV-B
- o SA: from 1-2 shift valve



1.2 CURRENT DATA			14/27
M	OIL TEMPERATURE		89 °C
	UD SOLENOID DUTY	99	%
	2ND SOLENOID DUTY	0	%
	OD SOLENOID DUTY	0	%
	RED SOLENOID DUTY	99	%
	PRESSURE SOLENOID	35	%
	SHIFT POSITION	1ST GEAR	
	SELECT LEVER SW.	D	
	FIX SCRN FULL PART GRPH HELP		

FIG.1)

1.2 CURRENT DATA			14/27
✱ OIL TEMPERATURE	-40	°C	
LR SOLENOID DUTY	0	%	
UD SOLENOID DUTY	99	%	
2ND S	signal circuit open		
OD S			
RED S			
PRESSURE SOLENOID			0
SHIFT POSITION	-		
FIX			SCRN
FULL			PART
GRPH			HELP

FIG.2)

1.2 CURRENT DATA		14/27
OIL TEMPERATURE	-43 °C	
LR SOLENOID DUTY	0 %	
UD SOLENOID DUTY	99 %	
2ND S	signal circuit short to ground	
OD S		
RED S		
PRESSURE SOLENOID		
SHIFT POSITION	-	
FIX	SCRN	FULL
PART	GRPH	HELP

FIG.3)

FIG.1) Normal

FIG.2) Signal harness Open

FIG.3) Signal harness Short

EKBF102A

Fig. 34: Gear Shift Operation Diagram - TCM Malfunction In 1st Or 2nd Gear
 Courtesy of KIA MOTORS AMERICA, INC.

NOTE:

- SA: Servo Apply pressure
- F/C: Front Clutch pressure
- R/C: Rear Clutch pressure
- K/D: Kick Down
- SCV: Shift Control Valve
- CSV: Control Switch Valve
- PCSV: Pressure Control Solenoid Valve
- SCSV: Shift Control Solenoid Valve
- PCV: Pressure Control Valve
- RCEV: Rear Clutch Exhaust Valve

AUTOMATIC TRANSAXLE HYDRAULIC CIRCUIT**PARK & NEUTRAL**

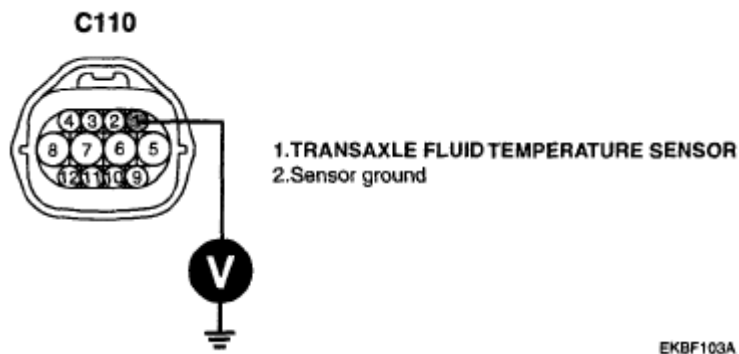


Fig. 35: Automatic Transaxle Hydraulic Circuit Diagram
Courtesy of KIA MOTORS AMERICA, INC.

D RANGE (1st)

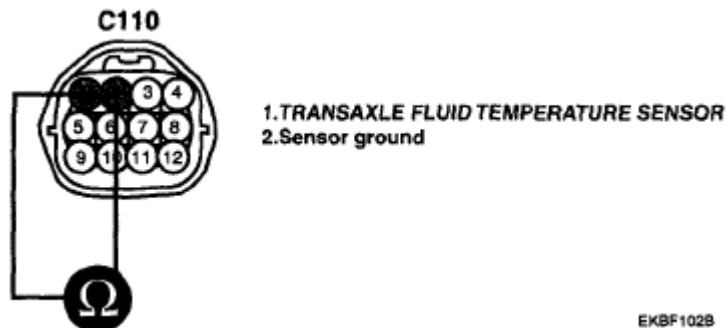


Fig. 36: Automatic Transaxle Hydraulic Circuit Diagram - D Range (1st)
Courtesy of KIA MOTORS AMERICA, INC.

D RANGE (2nd)

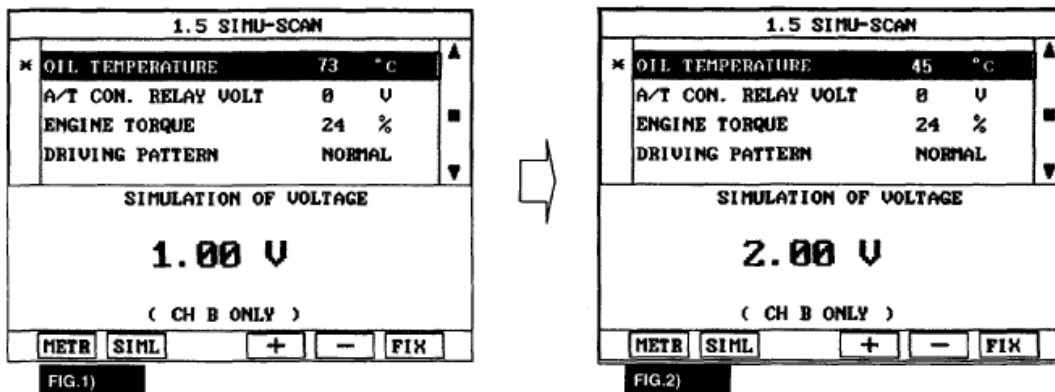


FIG.1) INPUT 1.00V → 73°C

FIG.3) INPUT 2.00V → 45°C

* The values are subject to change according to vehicle model or conditions.

EKBF102C

Fig. 37: Automatic Transaxle Hydraulic Circuit Diagram - D Range (2nd)
Courtesy of KIA MOTORS AMERICA, INC.

D RANGE (3rd)

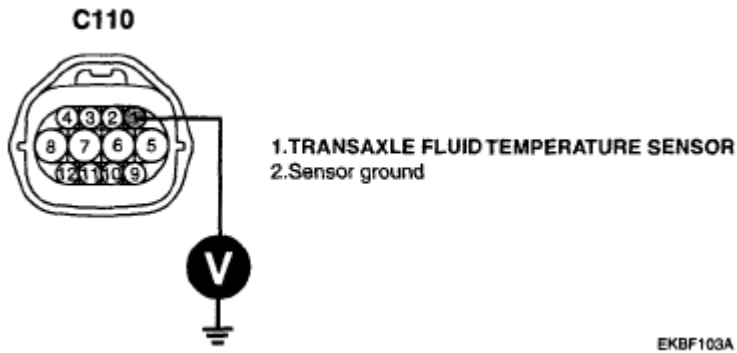


Fig. 38: Automatic Transaxle Hydraulic Circuit Diagram - D Range (3rd)
Courtesy of KIA MOTORS AMERICA, INC.

D RANGE (4th)

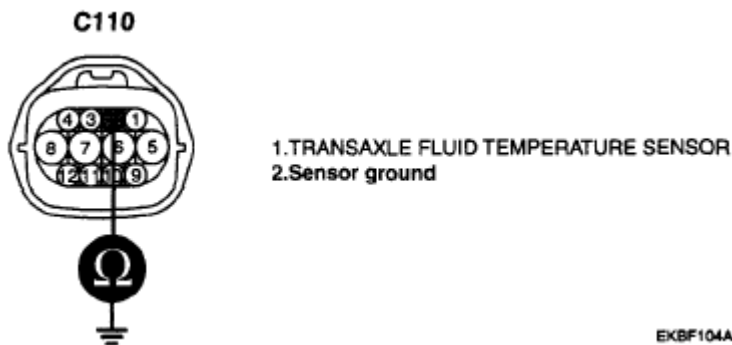


Fig. 39: Automatic Transaxle Hydraulic Circuit Diagram - D Range (4th)
Courtesy of KIA MOTORS AMERICA, INC.

LOCK

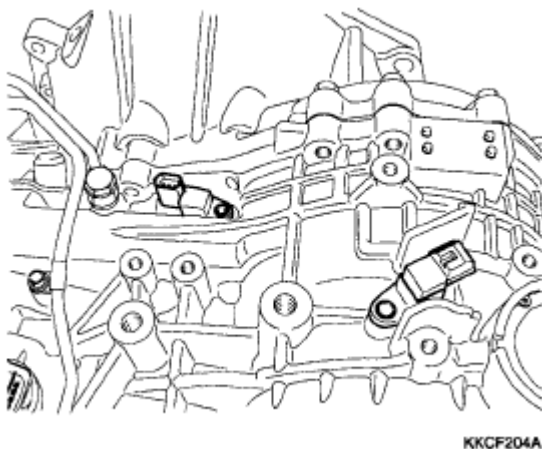


Fig. 40: Automatic Transaxle Hydraulic Circuit Diagram - Lock
Courtesy of KIA MOTORS AMERICA, INC.

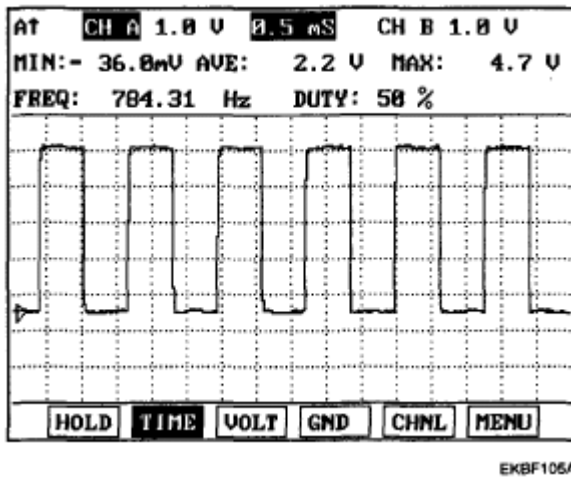


Fig. 42: Electronic Control System Communication Diagram
 Courtesy of KIA MOTORS AMERICA, INC.

SENSOR AND ACTUATOR FUNCTION

SENSOR AND ACTUATOR FUNCTION

Item	Functions
Input shaft speed sensor	Detect the turbine RPM at the E/C retainer
Output shaft speed sensor	Detect the T/F drive gear RPM at the transfer drive gear
Engine RPM signal	Receive the engine RPM via communication with ECU
Vehicle speed sensor	Detect the vehicle speed at the speedometer gear
Kickdown servo switch	Detect the operation starting of kickdown brake
Inhibitor switch	Detect the position of select lever through the contact switch
Overdrive switch	Detect the position of overdrive (4th gear)
TPS	Detect the throttle open angle through the potentiometer
Fluid temperature sensor	Detect the temperature of ATF through the thermistor
Torque reduction request signal	Transmit the torque reduction request signal to the engine ECU
Torque reduction operation/allowance/disallowance signal	Receive the signal of engine reduction pressure operation / allowance/disallowance from the ECU
Pressure control solenoid valve-A	Control the hydraulic pressure to the pressure control valve for shift control
Pressure control solenoid valve-B	Control the hydraulic pressure to the pressure control valve for shift control
Shifting control solenoid valve-A	Make the hydraulic passage for shift control
Shifting control solenoid valve-B	Make the hydraulic passage for shift control
Shifting control solenoid valve-C	Make the hydraulic passage for shift control
Damper clutch control solenoid valve	Control the hydraulic pressure for the damper clutch control
* E/C: End Clutch T/F: Transfer	

INTEGRATED TCM SIDE CONNECTOR

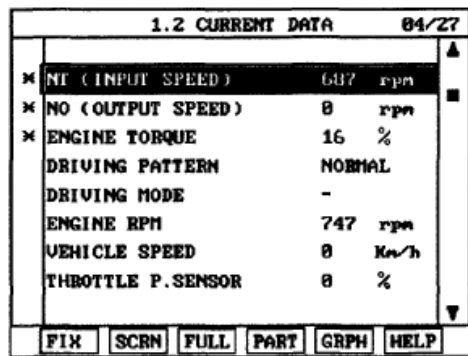


FIG.1)

FIG.1) Idling

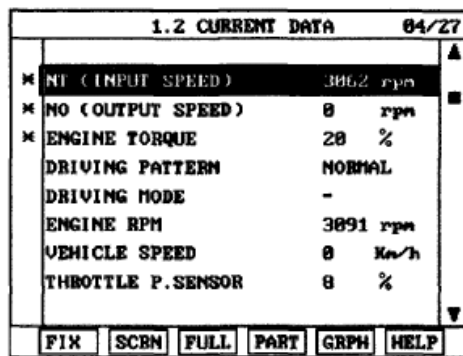


FIG.2)

FIG.2) Accelerating

EKB105B

Fig. 43: Identifying TCM Connector

Courtesy of KIA MOTORS AMERICA, INC.

INTEGRATED TCM INPUT/OUTPUT TERMINAL VOLTAGE

INTEGRATED TCM INPUT/OUTPUT TERMINAL VOLTAGE SPECIFICATIONS

PIN No.	Signal	Condition	Input/output value		Test result	Remark
			Type	Level		
4 5	Battery voltage (Main relay)	IG ON	DC Voltage	VBR	VBR	
26	Shift control solenoid valve- B	Shifting	DC Voltage	V_BAT Max. 1.0V Vpeak: Max. - 2V	14.01 V 9.2 mV -0.69 V	
27	Shift control solenoid valve- A	Shifting	DC Voltage	V_BAT Max. 1.0V Vpeak: Max. - 2V	14.01 V 9.6 mV -0.69 V	
48	Drive position PWM signal to trip computer	Idle '2' Position 'L' Position	Pulse Duty ?	HI: V_BAT or Vcc LO: Max. 1.0V Freq.: 50Hz±2% (Reference) 72.5±2% 12.5±2%	12.8 V 12 mV 50.0 Hz 72.5 % 12.5 %	
50	Shift control solenoid valve-	Shifting	DC Voltage	V_BAT Max. 1.0V Vpeak: Max. -	13.97 V 7.9 mV -0.78 V	

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	C			2V		
57	Fluid temperature sensor	Idling	Analog	0.5~4.5V	2.16V	@72°C (161.6°F)
60	Pulse Generator B	60kph	Sine Wave	Vp_p: Above 1.0V Freq.: 1.5~2.0kHz (Reference)	1.42 V 1.98 kHz	
61	Pulse Generator A	3,000rpm	Sine Wave	Vp_P: Above 1.0V Freq.: 1.1~1.3kHz (Reference)	3.86 V 1.25 kHz	
63	Brake SW	Release Push		Max. 0.5V V_BAT	0.0 mV 12.24 V	
66	Inhibitor SW "D"	"D" range Otherwise		V_BAT Max. 1.0V	14.15 V 3.4 mV	
67	Inhibitor SW "P"	"P" range Otherwise		V_BAT Max. 1.0V	14.21 V 4.2 mV	
68	Inhibitor SW "L"	"L" range Otherwise		V_BAT Max. 1.0V	14.15 V 3.7 mV	
70	PWR4 GND	Idling		Max. 50mV	-4.2mV	
71	Pressure control solenoid valve-A	Shifting	Pulse	HI: V_BAT LO: Max. - 3.0V Vpeak: Max. - 60V	13.8 V -0.85 V -13.5 V	(50.0Hz / 4.3kHz Chopping)
72	Pressure control solenoid valve-B	Shifting	Pulse	HI: V_BAT LO: Max. - 3.0V Vpeak: Max. - 60V	13.8 V -0.86 V -13.5 V	(50.0Hz / 4.3kHz Chopping)
80	Fluid temperature sensor GND	Idling	Analog	0.2V~4.9V	2.5V (58°C (136°F))	
82	Pulse Generator B	60kph	Sine Wave	Vp_p: Above 1.0V Freq.: 1.5~2.0kHz (Reference)	1.42 V 1.98 kHz	
83	Pulse Generator A	3,000rpm	Sine Wave	Vp_p: Above 1.0V Freq.: 1.5~2.0kHz (Reference)	3.86 V 1.25 kHz	

				1.1~1.3kHz (Reference)		
87	Kickdown (K/D) servo	1,3 speed 2,4 speed	DC Voltage	Max. 1.0V V_BAT	0.0 mV 13.41 V	
88	Inhibitor SW "R"	"R" range Otherwise		V_BAT Max. 1.0V	13.79 V 3.4 mV	
89	Inhibitor SW "2"	"2" range Otherwise		V_BAT Max. 1.0V	14.19 V 4.1 mV	
90	O/D OFF SW	OD OFF OD ON		V_BAT Max. 1.0V	14.21 V 0.0 mV	
91	Inhibitor SW "N"	"N" range Otherwise		V_BAT Max. 1.0V	14.22 V 3.6 mV	
94	Damper clutch solenoid valve	Lock Up ON	Pulse	HI: V_BAT LO: Max. - 3.0V Vpeak: Max. - 60V	13.9 V -0.87 V -13.5 V	(35.0Hz / 4.3kHz Chopping)

- V_BAT: Battery Voltage
- VBR: Converted battery voltage via main relay

TROUBLESHOOTING

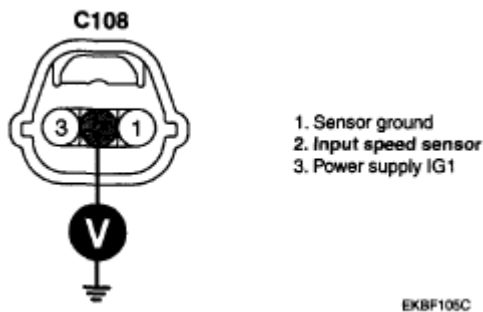


Fig. 44: Troubleshooting Flow Chart
Courtesy of KIA MOTORS AMERICA, INC.

DIAGNOSTIC TROUBLE CODES (INSPECTION PROCEDURE)

CHECK THE DIAGNOSTIC TROUBLE CODES

1. Turn the ignition switch to OFF.
2. Connect the Hi-scan tool to the DLC connector for diagnosis.
3. Turn the ignition switch to ON.
4. Check the diagnostic trouble codes using the Hi-scan tool.
5. Read the output diagnostic trouble codes. Then follow the remedy procedures according to the "DIAGNOSTIC TROUBLE CODE DESCRIPTION" on the following pages.

NOTE:

- A maximum of 10 diagnostic trouble codes (in the sequence of occurrence) can be stored in the Random Access Memory (RAM) incorporated within the control module.
- The same diagnostic trouble code can be stored one time only.
- If the number of stored diagnostic trouble codes or diagnostic trouble patterns exceeds 10, already stored diagnostic trouble codes will be erased in sequence, beginning with the oldest.
- Do not disconnect the battery until all diagnostic trouble codes or diagnostic trouble patterns have been read out, because all stored diagnostic trouble codes or diagnostic trouble patterns will be cancelled when the battery is disconnected.
- All diagnostic trouble codes are deleted from memory the 200th time the ATF temperature reaches 50°C (122°F) after memorization of the most recent diagnostic code.

6. Delete the diagnostic trouble code.

7. Disconnect the Hi-scan tool.

NOTE: DTC cleaning should only be done with the scan tool.

DIAGNOSTIC TROUBLE CODE TABLE**DIAGNOSTIC TROUBLE CODE CHART**

No.	Code	Item
1	<u>P0605</u>	INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR
2	<u>P0707</u>	TRANSAXLE RANGE SWITCH CIRCUIT LOW INPUT
3	<u>P0708</u>	TRANSAXLE RANGE SWITCH CIRCUIT HIGH INPUT
4	<u>P0711</u>	TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY
5	<u>P0712</u>	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT LOW INPUT
6	<u>P0713</u>	TRANSAXLE FLUID TEMPERATURE SENSOR CIRCUIT HIGH INPUT
7	<u>P0716</u>	A/T INPUT SPEED SENSOR (PG-A)-TOO MAX
8	<u>P0717</u>	A/T INPUT SPEED SENSOR (PG-A) CIRCUIT - OPEN or SHORT (GND)
9	<u>P0722</u>	A/T OUTPUT SPEED SENSOR (PG-B) CIRCUIT - OPEN or SHORT (GND)
10	<u>P0731</u>	GEAR 1 INCORRECT RATIO
11	<u>P0732</u>	GEAR 2 INCORRECT RATIO
12	<u>P0733</u>	GEAR 3 INCORRECT RATIO
13	<u>P0734</u>	GEAR 4 INCORRECT RATIO
14	<u>P0741</u>	TORQUE CONVERTER CLUTCH STUCK OFF
15	<u>P0742</u>	TORQUE CONVERTER CLUTCH STUCK ON
16	<u>P0743</u>	TCC CONTROL SOLENOID VALVE CIRCUIT - OPEN or SHORT (GND)
17	<u>P0745</u>	PRESSURE CONTROL SOLENOID VALVE-A CIRCUIT - OPEN or SHORT (GND)

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18	<u>P0750</u>	SHIFT CONTROL SOLENOID VALVE-A CIRCUIT - OPEN or SHORT (GND)
19	<u>P0755</u>	SHIFT CONTROL SOLENOID VALVE-B CIRCUIT - OPEN or SHORT (GND)
20	<u>P0760</u>	SHIFT CONTROL SOLENOID VALVE-C CIRCUIT - OPEN or SHORT (GND)
21	<u>P0775</u>	PRESSURE CONTROL SOLENOID VALVE-B CIRCUIT - OPEN or SHORT (GND)
22	<u>P1709</u>	KICKDOWN SERVO SWITCH CIRCUIT - OPEN or SHORT
23	<u>U0001</u>	CAN BUS OFF
24	<u>U0100</u>	CAN TIME OUT

NOTE:

- **D/C: Damper clutch**
- **PG-A: Input shaft rotation speed sensor**
- **PG-B: Output shaft rotation speed sensor**
- **PCSV: Pressure control solenoid valve**
- **SCSV: Shift solenoid valve**

CHECK THE CONTROL SYSTEM (USING THE HI-SCAN TOOL)

HI-SCAN TOOL REFERENCE CHART

Diagnosis items	Checking procedures		Probable cause
	Check conditions	Normal value	
Fluid temperature sensor	Engine doesn't operate before starting	Equivalent to outside air temperature	○ Malfunction of the fluid temperature sensor or the circuit harness
	While warming up engine	Gradual increase	
	After warming up engine	80~110°C (176~230°F)	
Kickdown servo switch	"L" range: Idling	ON	○ Malfunction of the kickdown servo adjustment ○ Malfunction of the kickdown servo switch or the circuit harness ○ Malfunction of the kickdown servo system
	"D" range: 1st or 3rd gear	ON	
	"D" range: 2nd or 4th gear	OFF	
Ignition signal • Engine rpm	"N" range: Idling	650-900rpm	○ Malfunction of the ignition system ○ Malfunction of the ignition signal pick-
	"N" range, 2500rpm (Tachometer)	2400-2600rpm	

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			up circuit
Idling switch	Accelerator pedal fully released	ON	- Malfunction of the TPS adjustment - Malfunction of the TPS or the circuit harness
	Press accelerator pedal slightly	OFF	
Air conditioning relay signal	"D" range: Air conditioning ON	ON	Malfunction of the air conditioning power relay circuit harness
	"D" range: Air conditioning OFF	OFF	
Transaxle range switch	"D" range: Idling	C (creep)	- Malfunction of the TCM - Malfunction of the idling switch system - Malfunction of the inhibitor switch system - Malfunction of the TPS system
	"L" range: Idling	1st gear	
	"2" range: 2nd gear	2nd gear	
	"D" range: Overdrive switch is turned OFF, 3rd gear	3rd gear	
	"D" range: Overdrive switch is turned ON, 4th gear	4th gear	
Pulse generator-A • Turbine rpm	"D" range: Engine stopped	0rpm	- Malfunction of the pulse generator-A or the circuit harness - Incoming noise from outside
	"D" range: Driving at 50km/h (31mph) in 3rd gear	1600~2000rpm	
	"D" range: Driving at 50km/h (31mph) in 4th gear	1100~1400rpm	
Pulse generator-B • Output shaft RPM sensor	"D" range: Engine stopped	0rpm	- Malfunction of the pulse generator-B or the circuit harness - Incoming noise from outside
	"D" range: Driving at 50km/h (31mph) in 3rd gear	1600~2000rpm	
	"D" range: Driving at 50km/h (31mph) in 4th gear	1600~2000rpm	
Overdrive switch	Overdrive switch is turned ON	OD: ON	Malfunction of the overdrive switch or the circuit harness
	Overdrive switch is turned OFF	OD: OFF	
Inhibitor switch	Shift select lever to "P" range	P	- Malfunction of the inhibitor switch adjustment - Malfunction of the
	Shift select lever to "R" range	R	
	Shift select lever to "N" range	N	

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	range		inhibitor switch or the circuit harness
	Shift select lever to "D" range	D	○ Malfunction of the manual control cable
	Shift select lever to "2" range	2	
	Shift select lever to "L" range	L	
Vehicle speed sensor	Keep vehicle stopped	0km/h	○ Malfunction of the vehicle speed sensor if high speed signal is delivered while vehicle is stopping
	Driving at 30km/h (19mph)	30km/h (19mph)	○ In other cases, malfunction of the vehicle speed sensor or circuit harness
	Driving at 50km/h (31mph)	50km/h (31mph)	
Pressure control solenoid valve duty (PCSV duty)	"D" range: Idling	60~80%	○ When accelerator pedal is slightly pressed while idling in "D" range, duty should become 100%
	"D" range: 1st gear	100%	○ Malfunction of the TCM
	"D" range: During shift	Varies with condition	○ Malfunction of the TPS system ○ Malfunction of the idling switch system
Damper clutch slip rpm • Turbine rpm	"D" range: 3rd gear, 1500rpm (Tachometer)	200~300rpm	○ Malfunction of the damper clutch ○ Malfunction of the ignition signal wire or pulse generator-B system
	"D" range: 3rd gear, 3500rpm (Tachometer)	0rpm	○ Abnormality transaxle fluid pressure ○ Malfunction of the damper clutch solenoid valve
DCCSV duty	"D" range: 3rd gear, 1500rpm (Tachometer)	0%	○ Malfunction of the TCM
			○ Malfunction of the

	"D" range: 3rd gear, 2500rpm (Tachometer)	Varies with load	TPS system o Malfunction of the pulse generator-B system
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FLUID LEAKS INSPECTION

Check for leaks from the transmission. If there are leaks, it is necessary to repair or replace O-ring, seal packing, oil seals, plugs or other parts.

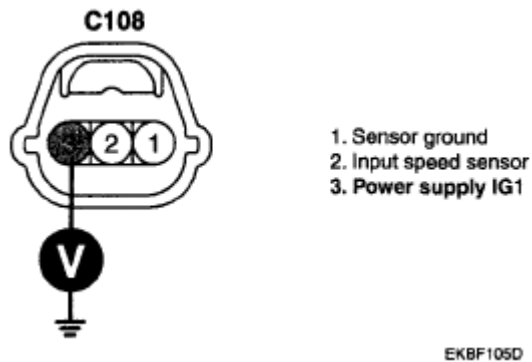


Fig. 45: Identifying O-Ring, Seal Packing With Oil Seals
Courtesy of KIA MOTORS AMERICA, INC.

TRANSAXLE FLUID LEVEL INSPECTION

1. Park the vehicle at even straight surface.
2. Before removing the oil level gauge, wipe all contaminants from around the oil level gauge.
3. Set the select lever to the "P" position and engage the parking brake and then start the engine.
4. Drive the vehicle until the fluid reaches normal. (80-90°C (176-194°F))
5. Move the select lever through all positions. This will fill the torque converter with transaxle fluid. Set the select lever to the "N" (Neutral) position.
6. Check that the fluid level is the "HOT" mark on the oil level gauge. If fluid level is low, add automatic transaxle fluid until the level reaches the "HOT" mark.

Automatic transaxle fluid:

GENUINE DIAMOND ATF SP-III or SK ATF SP-III

Quantity: 6.1--> (6.4 US qt, 5.4 Imp.qt)

NOTE: Low fluid level can cause a variety of abnormal conditions because it allows the pump to take in air along with fluid. Air trapped in the hydraulic system forms bubbles, which are compressible. Therefore, pressures will be erratic, causing delayed shifting, slipping clutches and brakes, etc. Improper filling can also raise fluid level too

high. When the transaxle has too much fluid, gears churn up foam and cause the same conditions which occur with low fluid level, resulting in accelerated deterioration of automatic transaxle fluid.

In either case, air bubbles can cause overheating, and fluid oxidation, which can interfere with normal valve, clutch, and brake operation.

Foaming can also result in fluid escaping from the transaxle vent where it may be mistaken for a leak.

Also check the condition of the transaxle fluid. If the fluid smells as if it is burning, it means that the fluid has been contaminated by fine particles from the bushes and friction material, a transaxle overhaul may be necessary.

Inspect the condition of fluid on the oil level gauge. For the detail check, drain some of the oil fluid out of the pump and then inspect the condition of the oil fluid. After checking, insert the oil level gauge into the oil filler tube securely.

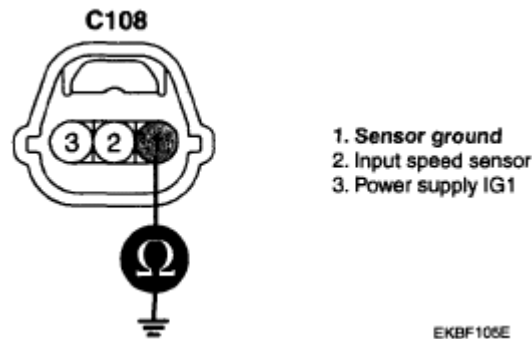


Fig. 46: Identifying Fluid Oil Level Gauge
Courtesy of KIA MOTORS AMERICA, INC.

When new, automatic transaxle fluid should be red. The red die is added so the assembly plant can identify it as transaxle fluid and distinguish it from engine oil or antifreeze. The red die, which is not an indicator of fluid quality, is not permanent. As the vehicle is driven the transaxle fluid will begin to look darker. The color may eventually appear light brown. But, the transaxle should be overhauled under the following conditions.

- If there is a "burning" door.
- If the fluid the color has become noticeably blacker.
- If there is a noticeably excessive amount of metal particle in the fluid.

HYDRAULIC PRESSURE TEST

1. Warm up the engine until the automatic transaxle fluid temperature is 80-100°C (176-212°F).
2. Jack up the vehicle so that the wheels are free to turn.
3. Connect the engine tachometer.

- Connect the oil pressure gauge (09452-21500) and the oil pressure gauge adapter (09452-21002, 09452-21001) to each pressure discharge port. But use the gauge (30kg/cm²) when measuring the reverse pressure, front clutch pressure and low & reverse brake pressure.

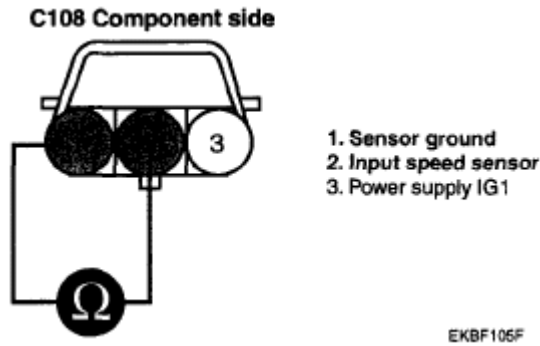


Fig. 47: Identifying Hydraulic Pressure Components Location
Courtesy of KIA MOTORS AMERICA, INC.

- If a value is outside the standard range, correct the problem while referring to the hydraulic pressure test diagnosis table.

STANDARD HYDRAULIC PRESSURE TEST

STANDARD HYDRAULIC PRESSURE TEST

No.	Measurement Condition			Standard hydraulic pressure kpa (kg/cm ² , psi)							
	Select lever position	Engine speed (rpm)	Shift position	1	2	3	4	5	6	7	8
				Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure	Dam clutch pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-	628~ (6.4~ 91~ D/C
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-	628~ (6.4~ 91~ D/C
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-	628~ (6.4~ 91~ D/C

5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)	235~ (2.4~ 34~ D/ OF
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)	265~ (2.7~ 38~ D/ OF

NOTE:

- "-" is 0.2 (0.3)kg/cm² or less and "()" is the reverse.
- **SW-ON:** Turn the overdrive control switch ON.
- **SW-OFF:** Turn the overdrive control switch OFF.
- The hydraulic pressure may be more than standard value at the ambient temperature.

DRIVE SHAFT OIL SEALS REPLACEMENT

1. Disconnect the drive shaft from the transaxle.
2. Using a flat-tip (-) screwdriver, remove the oil seal (A).

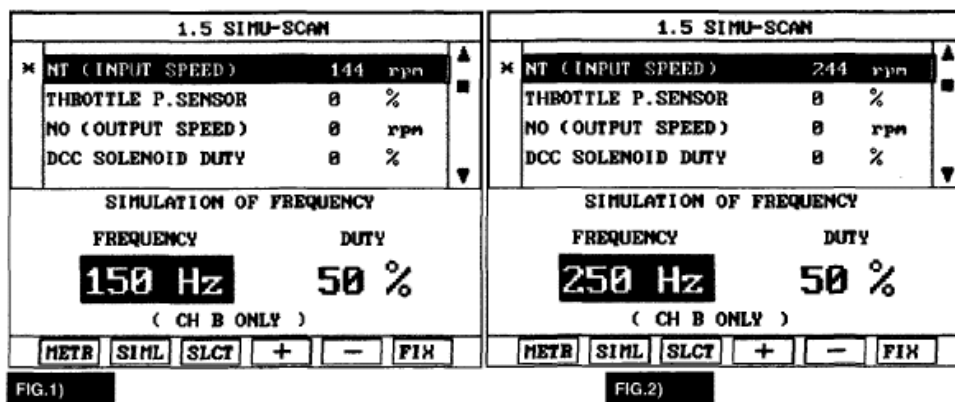


FIG.1) INPUT 150Hz → 144rpm

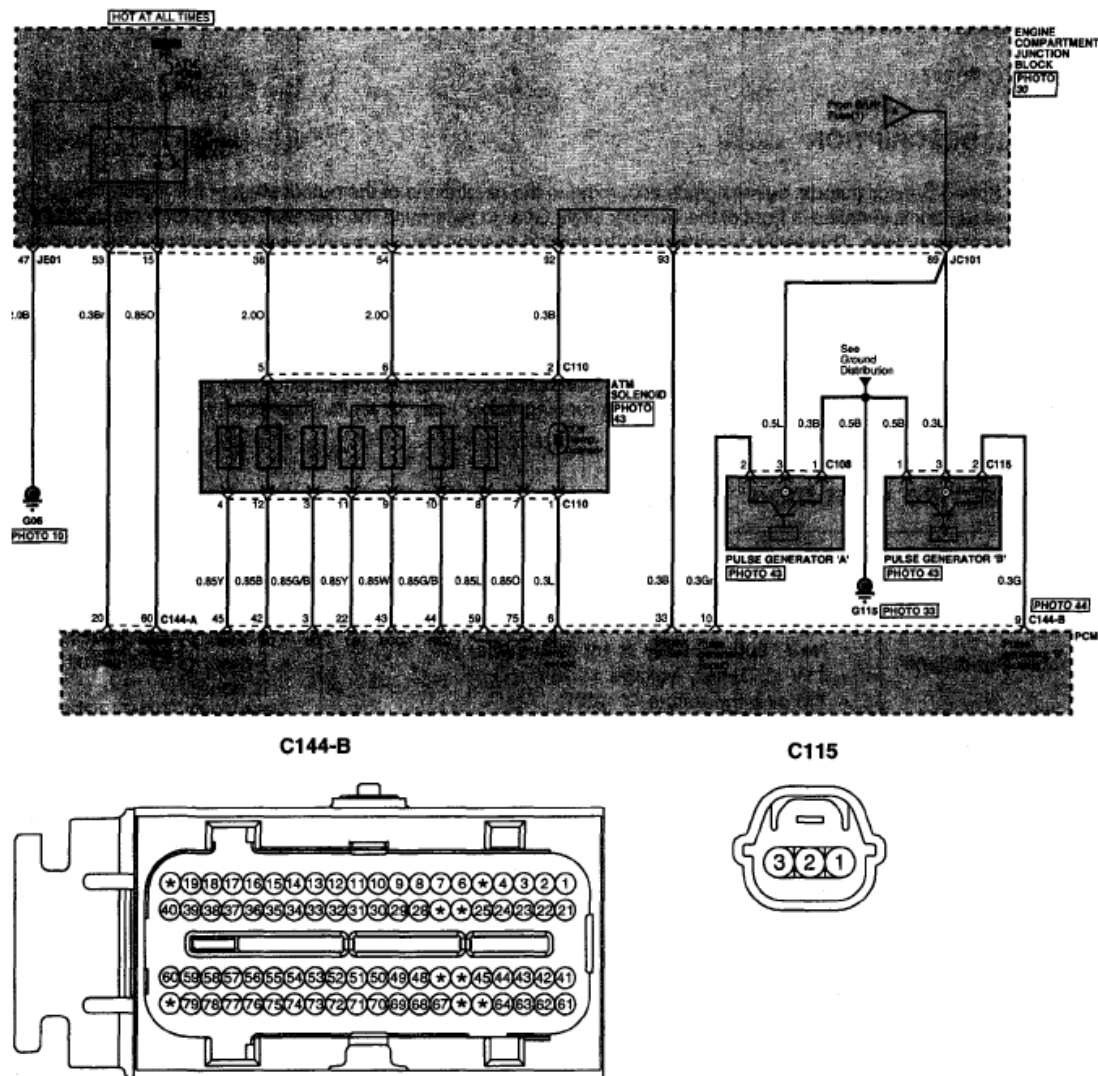
FIG.2) INPUT 250Hz → 244rpm

* The values are subject to change according to vehicle model or conditions

EKBF105G

Fig. 48: Identifying Drive Shaft Oil Seals (Right And Left)
Courtesy of KIA MOTORS AMERICA, INC.

3. Apply a coating of the transaxle fluid to the lip of the oil seal.
4. Using the special tool (09431-21200), tap the drive shaft oil seal into the transaxle.



EKBF100H

Fig. 49: Identifying Special Tool (09431-21200)
Courtesy of KIA MOTORS AMERICA, INC.

TORQUE CONVERTER STALL TEST

This test measures the maximum engine speed when the select lever is at the "D" or "R" position and the throttle is fully opened to test the operation of the torque converter overrunning clutch and the holding ability of clutch and brake in the transaxle.

NOTE: Do not let anybody stand in front of or behind the vehicle while this test is being carried out.

1. Check the automatic transaxle fluid level and temperature and the engine coolant temperature.
 - o Fluid level: At the HOT mark on the oil level gauge

- Fluid temperature: 80-90°C (176-194°F)
 - Engine coolant temperature: 80-90°C (176-194°F)
2. Apply chocks to both rear wheels.
 3. Connect the engine tachometer.
 4. Pull the parking brake lever on, with the brake pedal fully depressed.
 5. Start the engine.
 6. Move the select lever to the "D" position, fully depress the accelerator pedal and take a reading of the maximum engine speed at this time.

CAUTION:

- The throttle should not be left fully open for any more than 5 seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 r/min to let the automatic transaxle fluid cool down before carrying out subsequent tests.
- Move the select lever to the "R" position and carry out the same test again.

Stall RPM: 2,400~2,800 RPM

7. Move the select lever to the "R" position carry out the same test again.
 1. "Stall speed above specification in "D"

If stall speed is higher than specification, the rear clutch or overrunning clutch of the transaxle is slipping. In this case, perform a hydraulic test to locate the cause of slippage.

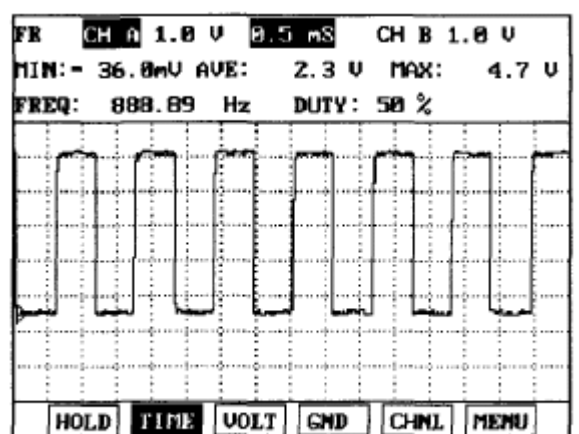
2. Stall speed above specification in "R"

If the stall speed is higher than specification, the front clutch of the transaxle or low & reverse brake is slipping. In this case, perform a hydraulic test to locate the cause of slippage.

3. Stall speed above specification in "D" and "R"

If the stall speed is lower than specification, insufficient engine output or a faulty torque converter is suspected.

DTC P0605 INTERNAL CONTROL MODULE READ ONLY MEMORY (ROM) ERROR**COMPONENT LOCATION**



EKBF106A

Fig. 50: Identifying Internal Control Module Components
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The PCM stores a "LEARNING VALUE" in an EEPROM to protect this value from being erased due to loss of electrical power.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check COMMUNICATION	Faulty PCM
Enable Conditions	COMMUNICATION ERROR WITH "EEPROM"	
Threshold Value	Communication fail	
Diagnostic Time		
Fail safe		

COMPONENT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
3. Using a scan tool, clear DTC.
4. Using a "SCAN TOOL", Operate "LEARNING" Reset.
5. Perform the "LEARNING"
6. IG OFF <--> IG ON (Repeat 2-3 times), and then monitor the "DTC"
7. Is DTC Re-displayed ?

YES : --> Substitute with a known-good PCM and check for proper operation. If the problem is

corrected, replace PCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. And go to **COMPONENT INSPECTION** Procedure.

METHOD OF LEARNING RESET

- SELECT LEVER POSITION IS "P" OR "N"
 - VEHICLE SPEED = 0 mph (0 km/h)
 - IGNITION "ON", ENGINE "OFF"
1. USING A SCAN TOOL, OPERATE "LEARNING" RESET
 2. IG "ON" <--> IG "OFF" (2~3 TIMES)

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode
2. Using a scan tool, clear DTC
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present ?

YES : --> Go to the applicable troubleshooting procedure

NO : --> System performing to specification at this time.

DTC P0707 TRANSAXLE RANGE SWITCH - NO INPUT

COMPONENT LOCATION

1.2 CURRENT DATA 04/27		
NO (OUTPUT SPEED)	377	rpm
ENGINE TORQUE	18	%
DRIVING PATTERN	NORMAL	
DRIVING MODE	-	
ENGINE RPM	1015	rpm
VEHICLE SPEED	15	Km/h
THROTTLE P.SENSOR	0	%
NT (INPUT SPEED)	949	rpm
FIX SCRN FULL PART GRPH HELP		

FIG.1)

FIG.1) Low-speed



1.2 CURRENT DATA 04/27		
NO (OUTPUT SPEED)	3005	rpm
ENGINE TORQUE	24	%
DRIVING PATTERN	NORMAL	
DRIVING MODE	-	
ENGINE RPM	2606	rpm
VEHICLE SPEED	130	Km/h
THROTTLE P.SENSOR	7	%
NT (INPUT SPEED)	2612	rpm
FIX SCRN FULL PART GRPH HELP		

FIG.2)

FIG.2) High-speed

EKBF106B

Fig. 51: Identifying Transaxle Range Switch Components Location

Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The Transaxle range switch sends the shift lever position information to the PCM using a 12V (battery voltage) signal. When the shift lever is in the D (Drive) position the output signal of transaxle range switch is 12V and in all other positions the voltage is 0V. The PCM judges the shift lever position by reading all signals, for the transaxle range switch, simultaneously.

DTC DESCRIPTION

The PCM sets this code when the transaxle range switch has no output signal for an extended period of time.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for No signal	• Open or short in circuit • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine speed > or = 500rpm • OUTPUT SPEED (PG-B) > or = 0rpm	
Threshold Value	• No signal detected	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous signal ◦ When P-D or R-D or D-R SHIFT is detected, it is regarded as N-D or N-R though "N" signal is not detected.	

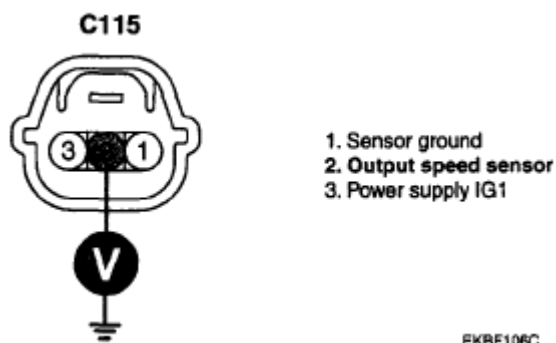
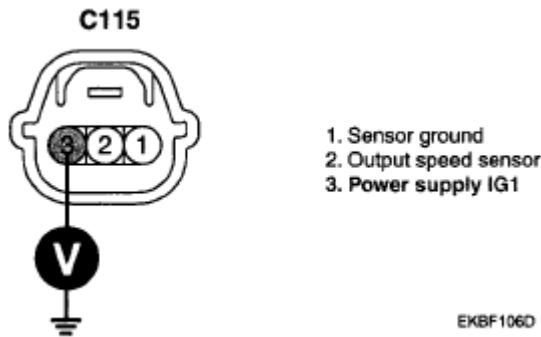
SCHEMATIC DIAGRAM

Fig. 52: Schematic Diagram

Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Monitor the TRANSAXLE RANGE SWITCH" parameter on the scantool.
4. Move selector lever from "P" range to "L" range.

**Fig. 53: Monitor Scantool Data - Screen Display**

Courtesy of KIA MOTORS AMERICA, INC.

5. Does "TRANSAXLE RANGE SWITCH" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES : --> Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**POWER SUPPLY CIRCUIT INSPECTION**" procedure.

POWER SUPPLY CIRCUIT INSPECTION

1. CHECK POWER TO RANGE SWITCH

1. Disconnect "TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.

Specification: approx. B+

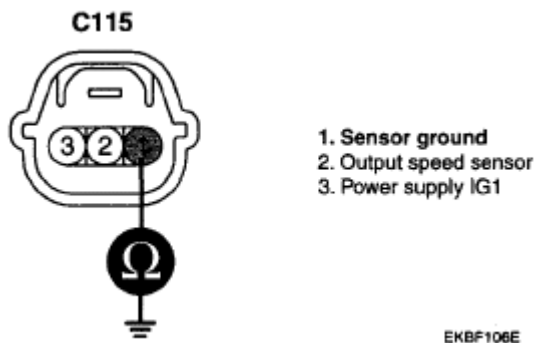


Fig. 54: Measuring Voltage Between Terminal Of Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO : --> Check that Fuse 5-10A is installed or not blown.

- Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each terminal of the sensor harness connector and PCM harness connector as below.

Specification: Shown below

TRANSAXLE RANGE SWITCH SPECIFICATIONS CHART

RANGE	L	2	P	R	D	N
Pin No of "TRANSAXLE RANGE SWITCH"	C11 No.2	C11 No.4	C11 No.9	C11 No.10	C11 No.11	C11 No.12
Pin No of	C01-1 No.68	C01-1 No.89	C01-1 No.67	C01-1 No.88	C01-1 No.66	C01-1 No.91

"PCM" harness						
Specification	0ohms	0ohms	0ohms	0ohms	0ohms	0ohms

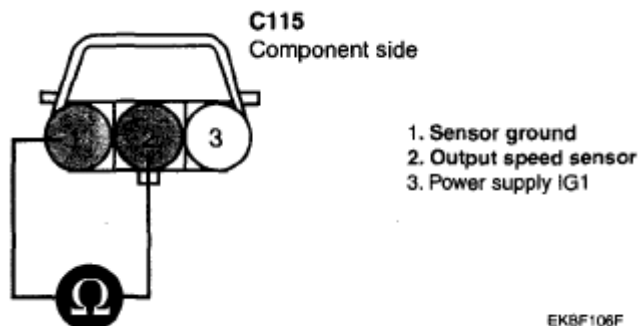


Fig. 55: Measuring Resistance Between Terminal Of Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. Ignition "OFF".
2. Remove "TRANSAXLE RANGE SWITCH".
3. Measure the resistance between each terminal of the transaxle range switch.

Specification: approx. 0 ohms

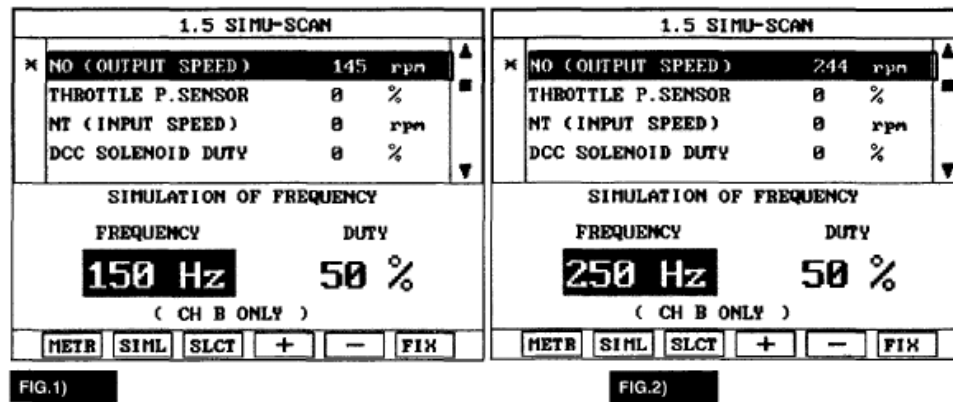
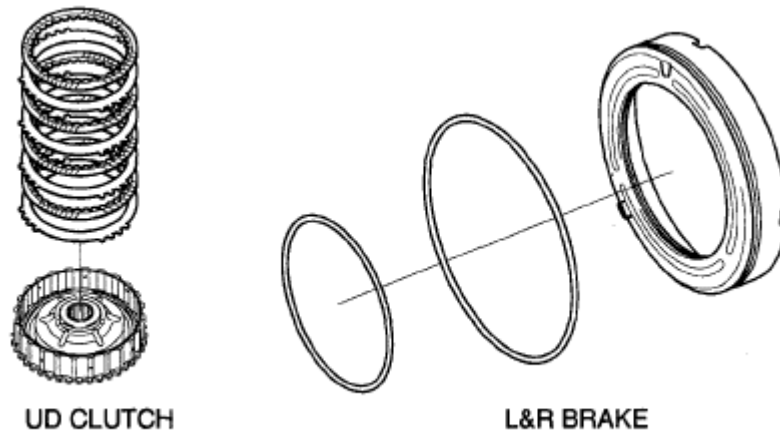


FIG.1) INPUT 150Hz → 144rpm
 FIG.2) INPUT 250Hz → 244rpm

* The values are subject to change according to vehicle model or conditions

EKBF106G

Fig. 56: Measuring Resistance Between Terminal Of Transaxle Range Switch
 Courtesy of KIA MOTORS AMERICA, INC.



EKBF300A

Fig. 57: Transaxle Range Switch Continuity Reference Chart
 Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace "TRANSAXLE RANGE SWITCH" as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC enable conditions in general information.
4. Are any DTCs present?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

DTC P0708 TRANSAXLE RANGE SWITCH - MULTI-INPUT

COMPONENT LOCATION

Refer to **DTC P0707**.

GENERAL DESCRIPTION

Refer to **DTC P0707**.

DTC DESCRIPTION

Refer to **DTC P0707**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check for multiple signals	• Open or short in TRANSAXLE RANGE SWITCH • Faulty TRANSAXLE RANGE SWITCH • Faulty PCM
Enable Conditions	• Engine speed > or = 500rpm • OUTPUT SPEED (PG-B) > or = 0rpm	
Threshold Value	• Multiple signal	
Diagnostic Time	• More than 30sec	
Fail Safe	• Recognition as previous signal ○ When signal is input "D" and "N" at the same time, PCM regards it as "N" RANGE. ○ After PCM reset, if the if the PCM detects multiple signal or no signal, then it holds	

the 3rd gear position.

SCHEMATIC DIAGRAM

Refer to **DTC P0707**.

MONITOR SCANTOOL DATA

Refer to **DTC P0707**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0707**.

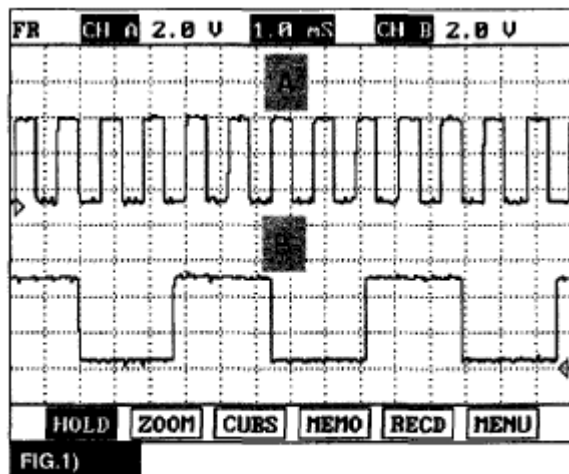
POWER SUPPLY CIRCUIT INSPECTION

1. Disconnect TRANSAXLE RANGE SWITCH" connector.
2. Ignition "ON" & Engine "OFF".
3. Measure voltage between each terminal of the sensor harness connector and chassis ground.

Specification: Shown below

CONNECTOR TERMINAL SPECIFICATIONS

TERMINAL (C11)	2	3	4	5	6	7	8	9	10	11	12
SPECIFICATION	0V	12V	0V	0V	12V	0V	0V	0V	0V	0V	0V



A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

EKBF107A

Fig. 58: Measuring Voltage Between Terminal Of Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

NO : --> Check for short in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect "TRANSAXLE RANGE SWITCH" and "PCM" connector.
3. Measure resistance between each terminals of the sensor harness to check for Short.

Specification: Infinite

1.2 CURRENT DATA		81/27
* ENGINE RPM	2495 rpm	
* NT (INPUT SPEED)	0 rpm	
* NO (OUTPUT SPEED)	0 rpm	
* SHIFT POSITION	1ST GEAR	
* SELECT LEVER SW.	D	
PRESSURE SOLENOID	99 %	
OIL TEMPERATURE	86 °C	
HOLD SWITCH	STANDARD	
FIX SCRN FULL PART GRPH HELP		

EKBF107B

Fig. 59: Measuring Resistance Between Terminals Of Sensor Harness To Check For Short
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

Refer to **DTC P0707**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0707**.

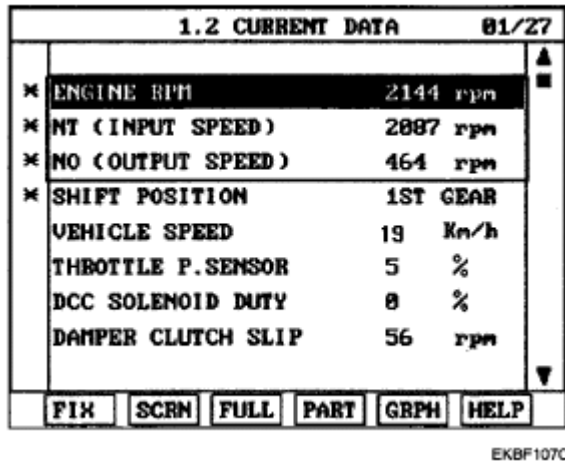
DTC P0711 TRANSAXLE FLUID TEMPERATURE SENSOR RATIONALITY**COMPONENT LOCATION**

Fig. 60: Identifying Transaxle Fluid Temperature Sensor Components Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The automatic transmission fluid (ATF) temperature sensor is installed in the valve body. This sensor uses a thermistor whose resistance changes according to the temperature changes. The PCM supplies a 5V reference voltage to the sensor, and the output voltage of the sensor changes when the ATF temperature varies. The automatic transmission fluid (ATF) temperature provides very important data for the PCM's control of the torque converter clutch, and is also used for many other purposes.

DTC DESCRIPTION

This DTC code is set when the ATF temperature output voltage is lower than the value generated by thermistor resistance, in a normal operating range, for approximately 1 second or longer. The PCM regards the ATF temperature as fixed at a value of 80°C (176°F), if this DTC is detected.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		Check for ground short	- Sensor signal circuit is short to ground - Faulty sensor - Faulty PCM
	Case 1	- Input speed > 600rpm - Engine speed > 600rpm	

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Enable Conditions	Case 2	• Engine speed > 1000rpm • Output speed < 500rpm • ATF temperature < 25°C (77°F) • Timer of ATF stuck monitoring > 600sec.
	Case 3	• ATF Temp, at IG ON > 45°C (113°F) • (ATF Temp, at IG OFF - Coolant Temp, at IG ON) > 30°C (86°F) • The variation of coolant temp. > 5°C (41°F) • Coolant temp, at IG ON > -20°C (-4°F)
Threshold Value	Case 1	• Change of voltage at 1sec > 0.5V
	Case 2	• (Present ATF Temp. - ATF Temp, when timer starts) < 3°C (37°F)
	Case 3	• (ATF Temp, at IG ON - Coolant Temp, at IG ON) > 10°C (50°F)
Diagnostic Time	Case 1	• More than 2 sees
	Case 2	• More than 600 sees
	Case 3	• More than 1 sec
Fail Safe		• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C (176°F)

SPECIFICATION

TEMPERATURE SPECIFICATION

Temp.[°C (°F)]	Resistance (kohms)	Temp.[°C (°F)]	Resistance (kohms)
-40 (-40)	139.5	80 (176)	1.08
-20 (-4)	47.7	100 (212)	0.63
0 (32)	18.6	120 (248)	0.38
20 (68)	8.1	140 (284)	0.25
40 (104)	3.8	160 (320)	0.16
60 (140)	1.98		

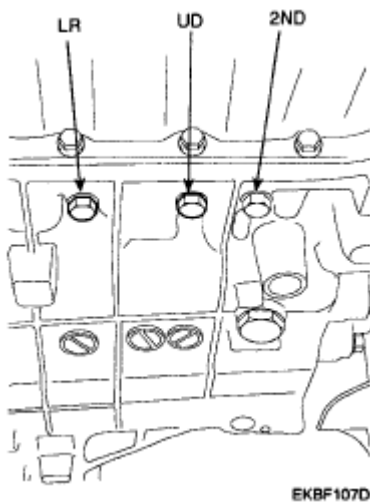
SCHEMATIC DIAGRAM

Fig. 61: Schematic Diagram
 Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "TRANSAXLE FLUID TEMPERATURE SENSOR" parameter on the scan tool.

Specification: Increasing gradually with increase in temperature

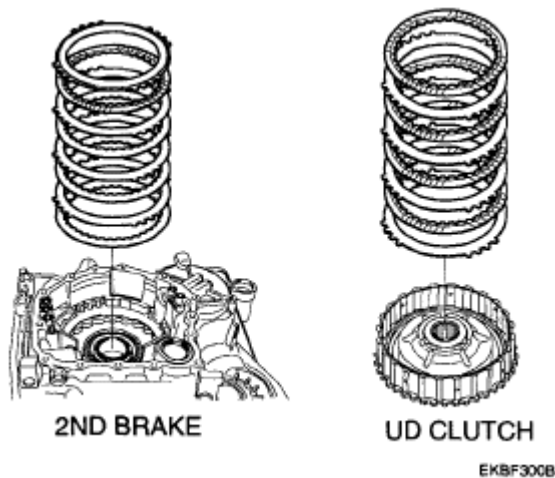


Fig. 62: Transaxle Fluid Temperature Sensor - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

4. Does "TRANSAXLE FLUID TEMPERATURE SENSOR" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES : --> Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the voltage between terminal "1" of the "TRANSAXLE FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification: Approx. 5 V

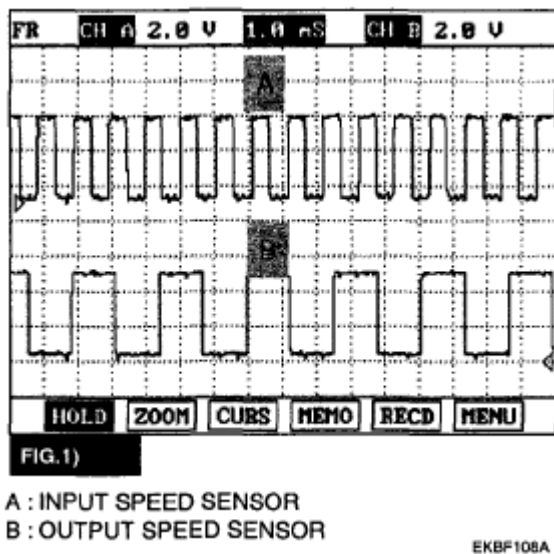


Fig. 63: Measuring Voltage Between Terminal Of Transaxle Fluid Temperature Sensor
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for short to ground in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK "TRANSAXLE FLUID TEMPERATURE SENSOR"

1. Ignition "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between terminals "1" and "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR".

Specification: Refer to "**REFERENCE DATA**"

TEMPERATURE REFERENCE SPECIFICATION DATA

Temp.[°C (°F)]	Resistance (kohms)	Temp.[°C (°F)]	Resistance (kohms)
-40 (-40)	139.5	80 (176)	1.08
-20 (-4)	47.7	100 (212)	0.63
0 (32)	18.6	120 (248)	0.38
20 (68)	8.1	140 (284)	0.25
40 (104)	3.8	160 (320)	0.16
60 (140)	1.98		

1.2 CURRENT DATA		01/27
✖ ENGINE RPM	2617 rpm	
✖ NT (INPUT SPEED)	0 rpm	
✖ NO (OUTPUT SPEED)	0 rpm	
✖ SHIFT POSITION	2ND GEAR	
✖ SELECT LEVER SW.	D	
PRESSURE SOLENOID	96 %	
OIL TEMPERATURE	86 °C	
HOLD SWITCH	STANDARD	
FIX		SCRN FULL PART GRPH HELP

EKBF108B

Fig. 64: Measuring Resistance Between Terminals Of Transmission Fluid Temperature Sensor

Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to 2 "CHECK PCM" as below.

NO : --> Replace "TRANSAXLE FLUID TEMPERATURE SENSOR" as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

2. CHECK PCM

1. Ignition "ON" & Engine "OFF".
2. Connect "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Install scantool and select SIMU-SCAN mode.
4. Simulate voltage (0-->5V) to "TRANSMISSION FLUID TEMPERATURE SENSOR" signal circuit.

1.2 CURRENT DATA		01/27
✖ ENGINE RPM	2144 rpm	
✖ NT (INPUT SPEED)	2183 rpm	
✖ NO (OUTPUT SPEED)	857 rpm	
✖ SHIFT POSITION	2ND GEAR	
VEHICLE SPEED	35 Km/h	
THROTTLE P.SENSOR	4 %	
DCC SOLENOID DUTY	0 %	
DAMPER CLUTCH SLIP	35 rpm	
FIX		SCRN FULL PART GRPH HELP

EKBF108C

Fig. 65: Transmission Fluid Temperature Sensor - Screen Display

Courtesy of KIA MOTORS AMERICA, INC.

5. Is FLUID TEMP. SENSOR signal value changed according to simulation voltage?

YES : --> Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

DTC P0712 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - LOW

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

Refer to **DTC P0711**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check for ground short	- Sensor signal circuit is short to ground - Faulty sensor
Enable Conditions	Battery voltage > 9V	
Threshold Value		

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	• Voltage < 0.1V	• Faulty PCM
Diagnostic Time	• More than 1sec	
Fail Safe	• Learning control and Intelligent shift are inhibited • Fluid temperature is regarded as 80°C (176°F)	

SPECIFICATION

Refer to **DTC P0711**.

SCHEMATIC DIAGRAM

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0711**.

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

DTC P0713 FLUID (OIL) TEMPERATURE SENSOR CIRCUIT - HIGH

COMPONENT LOCATION

Refer to **DTC P0711**.

GENERAL DESCRIPTION

Refer to **DTC P0711**.

DTC DESCRIPTION

Refer to **DTC P0711**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		Check voltage range	- Open in circuit - Faulty sensor - Faulty PCM
Enable Conditions	Case 1	- Battery Voltage > or = 9V - ATF temperature > or = -38°C (-36°F)	
	Case 2	- Engine speed > 1000rpm - Output speed > 500rpm - ATF temperature < -38°C (-36°F) - Engine coolant temp. > or = 70°C (158°F)	
Threshold Value		Voltage > 4.8V or 4.8V > Voltage > or = 4.45V	
Diagnostic Time	Case 1	1 sec	
	Case 2	161 sec	
Fail Safe		- Learning control and Intelligent shift are inhibited - Fluid temperature is regarded as 80°C (176°F)	

SPECIFICATION

Refer to **DTC P0711**.

SCHEMATIC DIAGRAM

Refer to **DTC P0711**.

MONITOR SCANTOOL DATA

Refer to **DTC P0711**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0711**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0711**.

GROUND CIRCUIT INSPECTION

1. Ignition "OFF".
2. Disconnect the "TRANSAXLE FLUID TEMPERATURE SENSOR" connector.
3. Measure the resistance between terminal "2" of the "TRANSMISSION FLUID TEMPERATURE SENSOR" harness connector and chassis ground.

Specification: Approx. 0 ohms

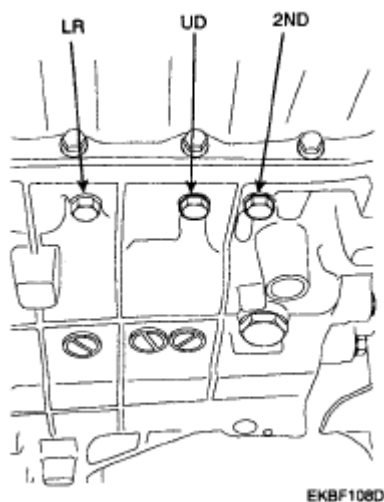


Fig. 66: Measuring Resistance Between Terminal Transmission Fluid Temperature Sensor
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

Refer to **DTC P0711**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0711**.

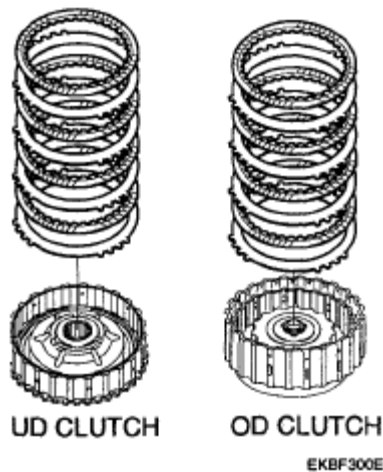
DTC P0716 INPUT SPEED SENSOR RANGE/PERFORMANCE**COMPONENT LOCATION**

Fig. 67: Identifying Input Speed Sensor Component Location
Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The input (turbine) speed sensor outputs waveform signals according to the revolutions of the input shaft, installed in front of end clutch retainer, of the transmission. The PCM determines the input shaft speed by calculating the frequency of the pulses. This value is mainly used to control the optimum fluid pressure during shifting.

DTC DESCRIPTION

The PCM sets this code if an output pulse-signal is not detected, from the INPUT SPEED SENSOR (PG-A), when the vehicle is running faster than 30 km/h (19 mile/h). The Fail-Safe function will be set by the PCM if this code is detected.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check voltage range	- Signal circuit is open or short - Sensor power circuit is open - Sensor ground circuit is open
Enable Conditions	Battery voltage > 9V	
Threshold Value	Input speed > or = 8000rpm	
Diagnostic Time	More than 1sec	

Fail Safe

- Locked into 3rd or 2nd gear
- Manual shifting is possible (2nd --> 3rd, 3rd --> 2nd)
- Faulty INPUT SPEED SENSOR
- Faulty PCM

SPECIFICATION

Input shaft & Output shaft speed sensor

- Type: Magnetic Inductive Type
- Sensor body and sensor connector have been unified as one.

SCHEMATIC DIAGRAM

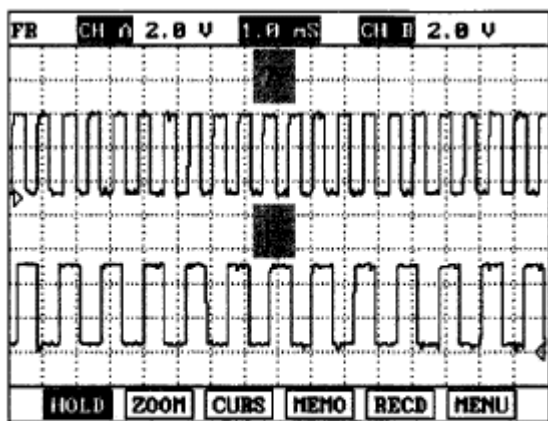


FIG.1)

A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

EKBF109A

Fig. 68: Schematic Diagram

Courtesy of KIA MOTORS AMERICA, INC.

SIGNAL WAVEFORM

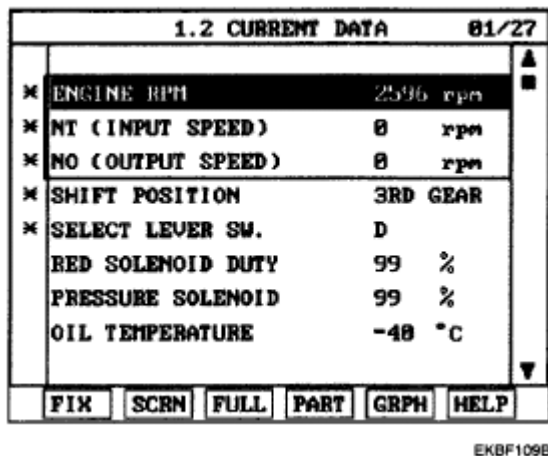


Fig. 69: Signal Waveform Graph
Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "INPUT SPEED SENSOR" parameter on the scan tool
4. Driving at speed of over 30 Km/h (19 mph).

Specification: Increasing gradually with increase in temperature

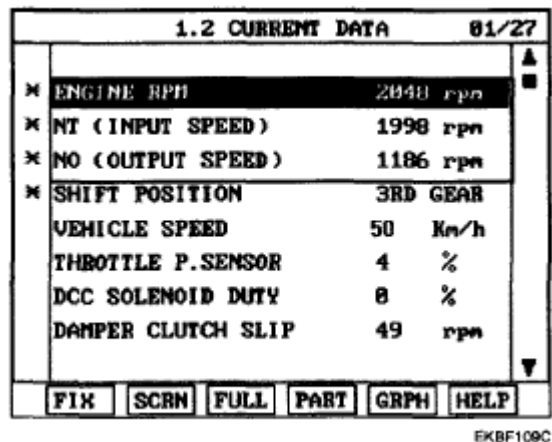


Fig. 70: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Does "INPUT SPEED SENSOR (PG-A)" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to

"VERIFICATION OF VEHICLE REPAIR" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system may be caused from poor harness and terminals. These faults can be caused by interference from other electrical systems and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

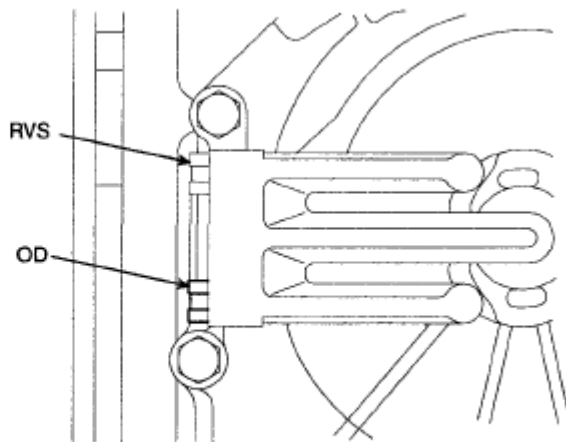
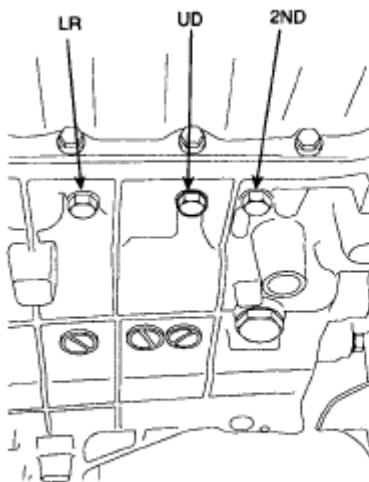
YES : --> Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "1" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification: approx. $2.5V \pm 1.2V$



EKBF109D

Fig. 71: Measuring Voltage Between Terminal Of Input Speed Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**GROUND CIRCUIT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "**COMPONENT INSPECTION**" procedure.

GROUND CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure voltage between terminal "2" of the INPUT SPEED SENSOR harness connector and chassis ground.

Specification: approx. 2.5V

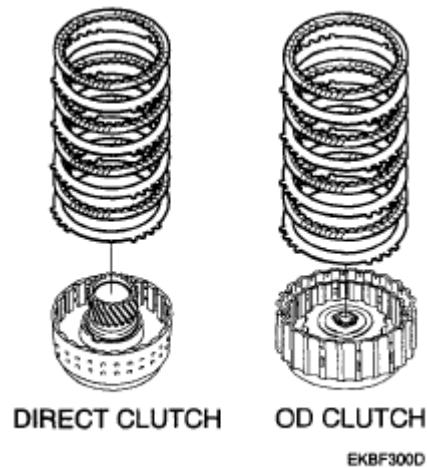


Fig. 72: Measuring Voltage Between Terminal Of Input Speed Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specification ?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If ground circuit in harness is OK, go to step 2 CHECK PCM of the "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. Check "INPUT SPEED SENSOR (PG-A)"
 1. Ignition "OFF".

2. Disconnect the "INPUT SPEED SENSOR" connector.
3. Measure resistance between terminal "1" and "2" of the "INPUT SPEED SENSOR" connector.

Specification: 245 ± 30 ohms /20°C (68°F)

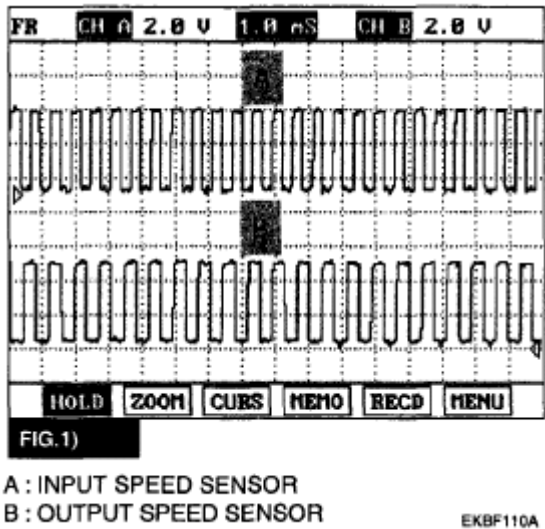


Fig. 73: Measuring Resistance Between Terminal Of Input Speed Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to step 2 CHECK PCM as below.

NO : --> Replace "INPUT SPEED SENSOR" as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM

1. Ignition "ON" & Engine "OFF".
2. Connect "INPUT SPEED SENSOR" connector.
3. Install scantool and select SIMU-SCAN mode.
4. Simulate frequency to INPUT SPEED SENSOR signal circuit.

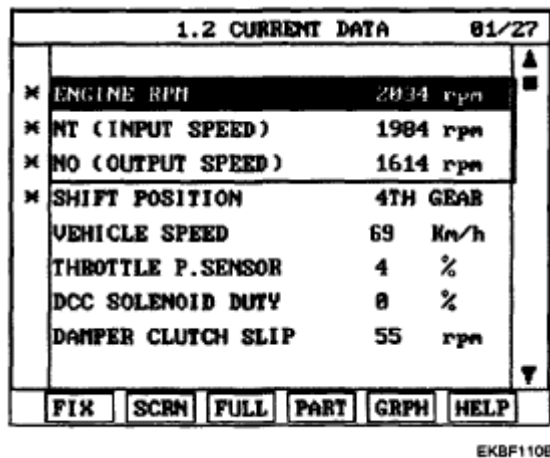


Fig. 74: Input Speed Sensor - Screen Display
 Courtesy of KIA MOTORS AMERICA, INC.

5. Is "INPUT SPEED SENSOR (PG-A)" signal value changed according to simulation frequency?

YES : --> Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC enable conditions in general information.
4. Is resistance within specification ?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

DTC P0717 INPUT SPEED SENSOR CIRCUIT - NO SIGNAL

COMPONENT LOCATION

Refer to **DTC P0716**.

GENERAL DESCRIPTION

Refer to **DTC P0716**.

DTC DESCRIPTION

Refer to **DTC P0716**.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check voltage range	- Signal circuit is open or short - Sensor power circuit is open - Sensor ground circuit is open - Faulty INPUT SPEED SENSOR - Faulty PCM
Enable Conditions	- Vehicle speed is over 19 Mile/h (30 Km/h) in D,2, L (A/T range switch) - Battery voltage > 9V - Output speed sensor > 1000rpm - Engine speed (Only 1st gear) > 3000rpm	
Threshold Value	No signal	
Diagnostic Time	More than 1sec	
Fail Safe	- Locked into 3rd or 2nd gear - Manual shifting is possible (2nd --> 3 rd, 3 rd --> 2nd)	

SPECIFICATION

Refer to **DTC P0716**.

SCHEMATIC DIAGRAM

Refer to **DTC P0716**.

SIGNAL WAVEFORM

Refer to **DTC P0716**.

MONITOR SCANTOOL DATA

Refer to **DTC P0716**.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0716**.

SIGNAL CIRCUIT INSPECTION

Refer to **DTC P0716**.

GROUND CIRCUIT INSPECTION

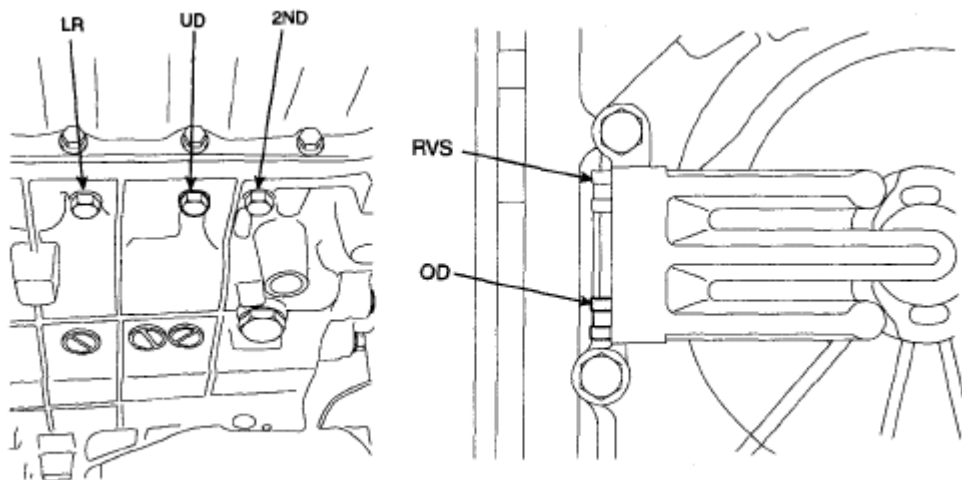
Refer to **DTC P0716**.

COMPONENT INSPECTION

Refer to **DTC P0716**.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0716**.

DTC P0722 OUTPUT SPEED SENSOR CIRCUIT - NO SIGNAL**COMPONENT LOCATION**

EKBF110C

Fig. 75: Identifying Output Speed Sensor Component Location
Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The OUTPUT SPEED SENSOR (PG-B) outputs waveform signals according to the revolutions of the output shaft of the transmission. The OUTPUT SPEED SENSOR (PG-B) is installed in front of the Transfer Drive Gear and determine the Transfer Drive Gear RPMs by calculating the frequency of the pulses. This value, together with the throttle position data, is mainly used to decide the optimum gear position.

DTC DESCRIPTION

The PCM sets this code if the calculated value of the pulse-signal is noticeably different from the value calculated, using the Vehicle Speed Sensor output, when the vehicle is running faster than 19 mph (30 km/h). The PCM will initiate the fail safe function if this code is detected.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

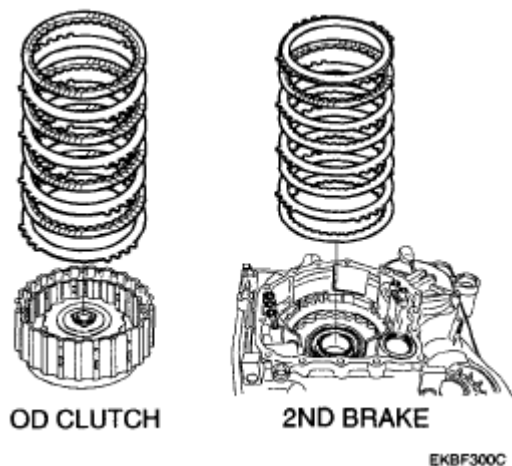
Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		Speed rationality check	- Signal circuit is open or short - Sensor power circuit is open - Sensor ground circuit is open - Faulty OUTPUT SPEED SENSOR - Faulty PCM
Enable Conditions	Case 1	- Vehicle speed is over 19 Mile/h (30 Km/h) in D, 2, L (A/T range switch) - Throttle opening > 14.9% - Engine speed > 3500 rpm	
	Case 2	- Vehicle speed is over 19 Mile/h (30 Km/h) in D, 2 (A/T range switch) - Input speed > 1500 rpm - Engine speed > 3500 rpm	
Threshold Value		Output speed = 0 rpm	
Diagnostic Time		More than 5 sec	
Fail Safe		- Locked into 3rd or 2nd gear - Manual shifting is possible (2nd --> 3rd, 3rd --> 2nd)	

SPECIFICATION

Refer to **DTC P0716**.

SCHEMATIC DIAGRAM

Refer to **DTC P0716**.

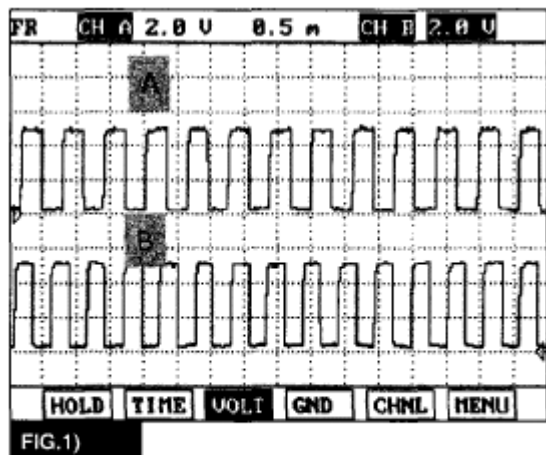
SIGNAL WAVEFORM**Fig. 76: Signal Waveform Graph**

Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "OUTPUT SPEED SENSOR (PG-B)" parameter on the scantool.
4. Driving at speed of over 30 Km/h (19 mile/h).

Specification: Increasing gradually with increase in temperature



A : INPUT SPEED SENSOR
B : OUTPUT SPEED SENSOR

EKB111A

Fig. 77: Scantool Data - Screen Display

Courtesy of KIA MOTORS AMERICA, INC.

5. Does "OUTPUT SPEED SENSOR (PG-B)" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0716**.

SIGNAL CIRCUIT INSPECTION

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR (PG-B)" connector.
3. Measure voltage between terminal "1" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification: approx. $2.5V \pm 1.2V$

1.2 CURRENT DATA		81/27
* ENGINE RPM	2020 rpm	
* INT (INPUT SPEED)	1958 rpm	
* NO (OUTPUT SPEED)	2276 rpm	
* SHIFT POSITION	5TH GEAR	
VEHICLE SPEED	98 Km/h	
THROTTLE P.SENSOR	6 %	
DCC SOLENOID DUTY	8 %	
DAMPER CLUTCH SLIP	76 rpm	
FIX SCRN FULL PART GRPH HELP		

EKBF111B

Fig. 78: Measuring Voltage Between Terminal Of Output Speed Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specification?

YES : --> Go to "**GROUND CIRCUIT INSPECTION**" procedure.

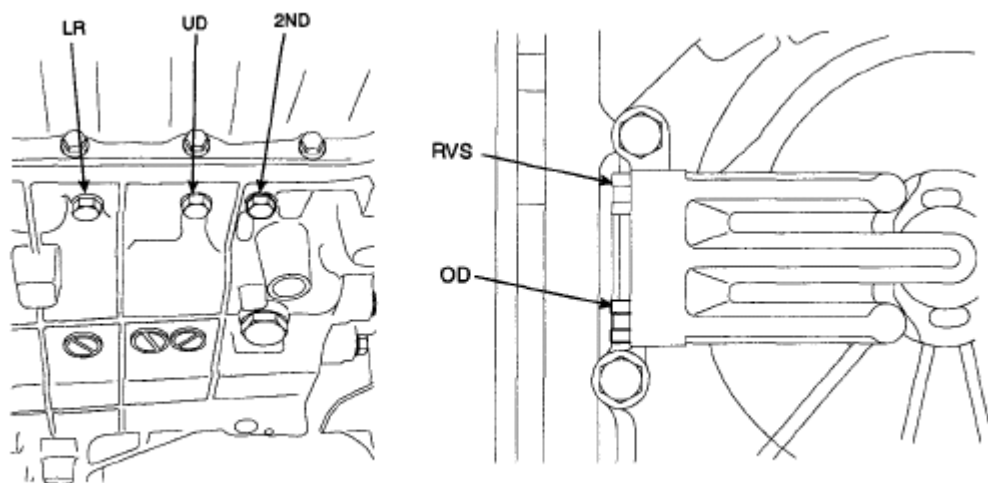
NO : --> Check for open or short in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

- If signal circuit in harness is OK, go to step 2 CHECK PCM of the "**COMPONENT**"

INSPECTION" procedure.**GROUND CIRCUIT INSPECTION**

1. Ignition "ON" & Engine "OFF".
2. Disconnect the "OUTPUT SPEED SENSOR (PG-B)" connector.
3. Measure voltage between terminal "2" of the OUTPUT SPEED SENSOR harness connector and chassis ground.

Specification: approx. 2.5V



EKBF111C

Fig. 79: Measuring Voltage Between Terminal Of Output Speed Sensor Harness Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specification?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If ground circuit in harness is OK, go to step 2 CHECK PCM of the "Component inspection" procedure.

COMPONENT INSPECTION

1. Check "OUTPUT SPEED SENSOR (PG-B)"
 1. Ignition "OFF".
 2. Disconnect the "OUTPUT SPEED SENSOR" connector.
 3. Measure resistance between terminal "1" and "2" of the "OUTPUT SPEED SENSOR" connector.

Specification: 245 ± 30 ohms /20°C (68°F)

1.2 CURRENT DATA		86/24
* 01. ENGINE SPEED	3459 rpm	▲
* 04. INPUT SPEED SENSOR	3457 rpm	■
* 05. OUTPUT SPEED SENSOR	3984 rpm	
* 06. DCCSU DUTY	81.2 %	
* 07. DAMP. CLUTCH SLIP	2 rpm	
* 15. SELECT LEVER POSI.	D	
16. A/C SWITCH		
17. IDLE SWITCH		
FIX	PART	FULL
HELP	GRPH	BCRD

FIG.1)

FIG.1) : Normal status

EKBF113A

Fig. 80: Measuring Resistance Between Terminal 1 And 2 Of Output Speed Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace "OUTPUT SPEED SENSOR (PG-B)" as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM

1. Ignition "ON" & Engine "OFF".
2. Connect "OUTPUT SPEED SENSOR" connector.
3. Install scantool and select SIMU-SCAN mode.
4. Simulate frequency to "OUTPUT SPEED SENSOR (PG-B)" signal circuit.

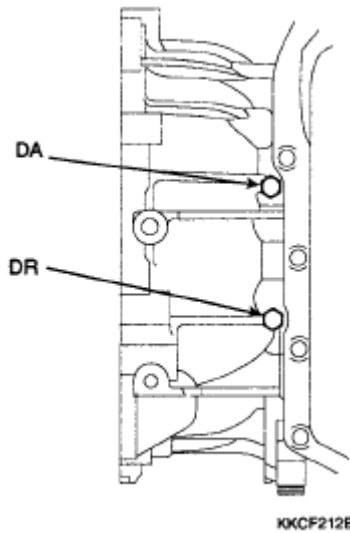


Fig. 81: Output Speed Sensor (PG-B) - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Is "OUTPUT SPEED SENSOR (PG-B)" signal value changed according to simulation frequency?

YES : --> Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage. Repair or replace as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and then go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0716**.

DTC P0731 GEAR 1 INCORRECT RATIO

COMPONENT LOCATION

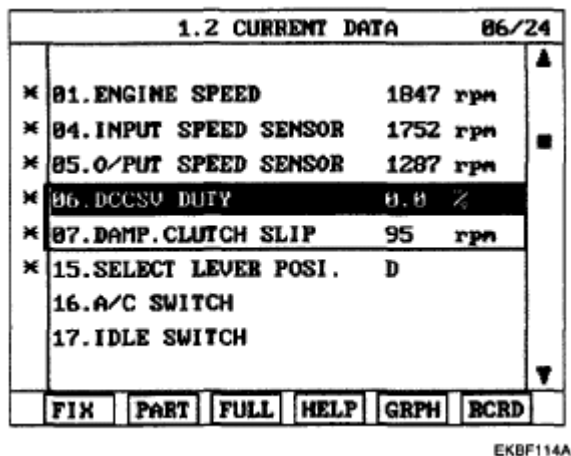


Fig. 82: Identifying Gear 1 Incorrect Ratio Component Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 1st gear ratio, while the transaxle is engaged in the 1st gear. For example, if the input speed is 1000 RPM and the 2nd gear ratio is 2.846, then the output speed is about 2846 RPM.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 1st gear ratio, while the transaxle is engaged in 1st gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	1st gear incorrect ratio	- Faulty input speed sensor - Faulty output speed sensor - Faulty R/C or OWC
Enable Conditions	- Engine speed > 400rpm - Output speed (PG-B) > 300rpm - Shift stage 1st gear - Input speed (PG-A) > 300rpm - A/T fluid temp. > -10°C (14°F) - TRANSAXLE RANGE SWITCH is normal - Solenoid is normal	F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kickdown brake L/R - Low & Reverse brake

Threshold Value	• Input speed (Nt) > (1st gear ratio x Output speed + 200)
Diagnostic Time	• More than 1sec
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0731 is output four times, the transaxle is locked into 3rd gear)

SCHEMATIC DIAGRAM

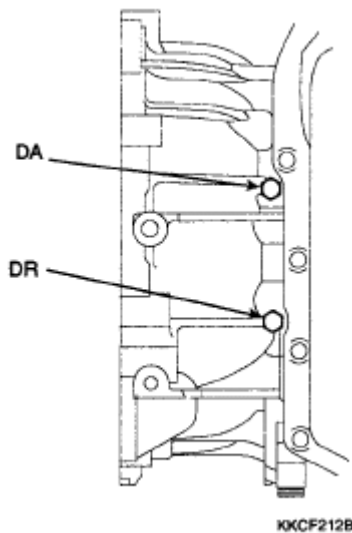


Fig. 83: Schematic Diagram
Courtesy of KIA MOTORS AMERICA, INC.

SIGNAL WAVEFORM

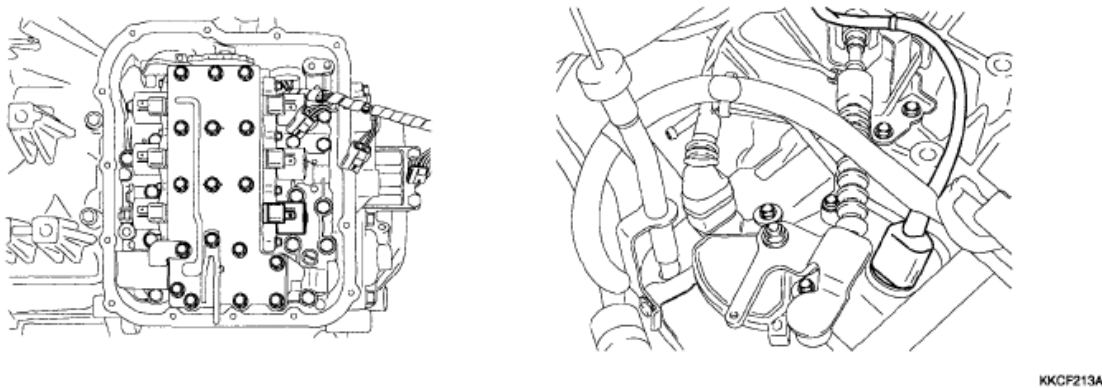


Fig. 84: Signal Waveform Graph
Courtesy of KIA MOTORS AMERICA, INC.

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR (PG-A), OUTPUT SPEED SENSOR (PG-B), GEAR POSITION" parameter on the scan tool.
4. Perform the "STALL TEST" at gear position "1"

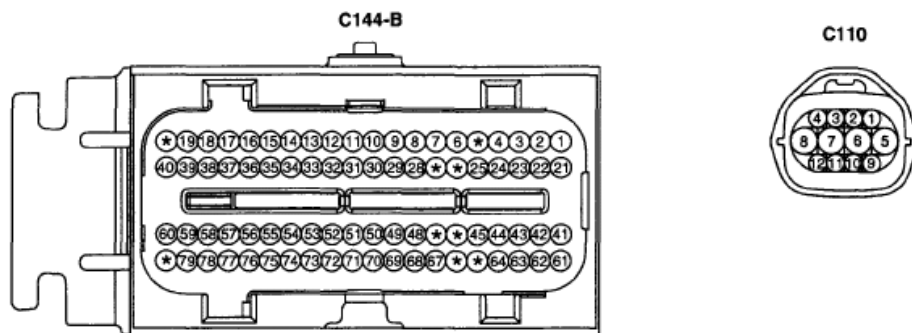
[illegible]

Fig. 85: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

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2006 Kia Rio

2006-07 TRANSMISSION Automatic Transaxle System - Rio

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	o						
R	-	Reverse			o					
N	-	Neutral	Possible							o
D	ON	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
		4th					o		o	
D	OFF	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
2	-	1st				o		o		
		2nd				o			o	
L	-	1st				o				o
C1: Front clutch C2: Rear clutch C3: End clutch OWC: One way clutch B1: Kickdown brake B2: Low & reverse brake										

Stall test procedure in D1 and reason

Procedure

1. Warm up the engine
2. Fully depress the brake pedal, then place the transaxle gear lever into "D" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM value.

* The slippage of 1st gear operating parts can be detected by stall test in D1.

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 1st gear operating part has faults, input speed revolution will be out of specification.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES : --> Go to **SIGNAL CIRCUIT INSPECTION** procedure.

NO : --> Go to "**COMPONENT INSPECTION**" procedure.

CAUTION:

- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature: 176 °F~212 °F (80~100 °C).
 - Engine coolant temperature: 176 °F~212 °F (80~100 °C).
- Chock both rear wheel (left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.
- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 RPM to let the A/T fluid cool down before carrying out subsequent tests.

* Perform stall test on "L" range If the result of stall test on "D" range is out of specifications.

"One Way Clutch" is faulty If the result of stall test on "L" range is within specifications.

SIGNAL CIRCUIT INSPECTION

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR, OUTPUT SPEED SENSOR, GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" at gear position "1".

Specification: INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

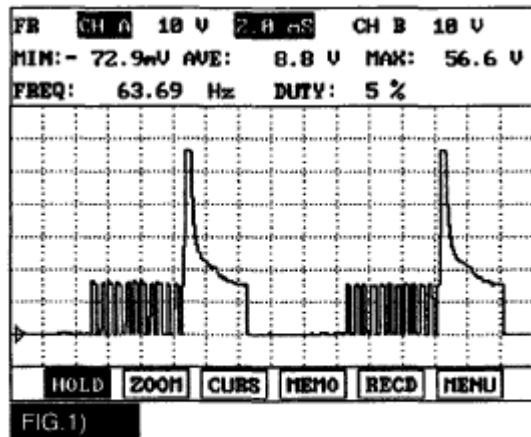


FIG.1) : Operating of "DCCSV"

EKBF115A

Fig. 86: Scantool Data - Screen Display

Courtesy of KIA MOTORS AMERICA, INC.

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES : --> Go to "COMPONENT INSPECTION" procedure.

NO : --> Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "VERIFICATION OF VEHICLE REPAIR" procedure.

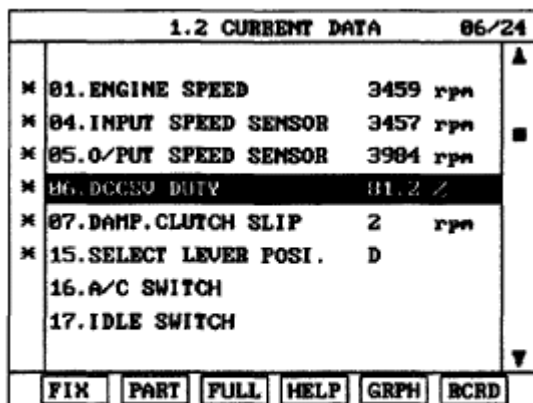
COMPONENT INSPECTION

FIG.1) : Normal status

EKBF115B

Fig. 87: Identifying Pressure Ports

Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "R/C (rear clutch)" port.

2. Engine "ON".
3. Drive a car at gear position 1 in "D RANGE".
4. Compare actual value to specifications.

Specification: Shown below

HYDRAULIC PRESSURE - MEASUREMENT CONDITION

No.	Measurement Condition			Standard hydraulic pressure kpa (kg/cm ² , psl)						
	Select lever position	Engine speed (rpm)	Shift position	1	2	3	4	5	6	7
				Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)

NOTE:

- "-" is 0.2 (0.3)kg/cm² or less and " ()" is the reverse.
- SW-ON: Turn the overdrive control switch ON.
- SW-OFF: Turn the overdrive control switch OFF.
- The hydraulic pressure may be more than standard value at the

ambient temperature.

* The values are subject to change according to vehicle model or condition

5. Is oil pressure value within specification?

YES : --> Repair AUTO TRANSAXLE (Clutch or brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)11 mode.
2. Using a scan tool, clear DTC.
3. Operate the vehicle within DTC enable conditions in general information.
4. Are any DTCs present ?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

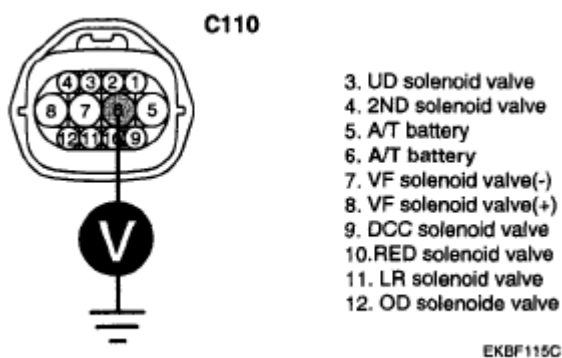
DTC P0732 GEAR 2 INCORRECT RATIO**COMPONENT LOCATION**

Fig. 88: Identifying Gear 2 Incorrect Ratio Component Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the

2nd gear ratio, while the transaxle is engaged in the 2nd gear. For example, if the input speed is 1000 RPM and the 2nd gear ratio is 1.581, then the output speed is 1581 RPM.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 2nd gear ratio, while the transaxle is engaged in 2nd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	2nd gear incorrect ratio	- Faulty input speed sensor - Faulty output speed sensor - Faulty R/C or K/D F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch K/B - Kickdown brake L/R - Low & Reverse brake
Enable Conditions	- Engine speed > 400rpm - Output speed (PG-B) > 600rpm - Shift stage 2nd gear - Input speed (PG-A) > 300rpm - A/T fluid temp. > -10°C (14°F) - TRANSAXLE RANGE SWITCH is normal - Solenoid is normal	
Threshold Value	Input speed/2nd gear ratio - output speed > or = 200rpm / 2nd gear ratio	
Diagnostic Time	More than 1 sec	
Fail Safe	Locked into 3rd gear. (If diagnosis code P0732 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

Refer to **DTC P0731**.

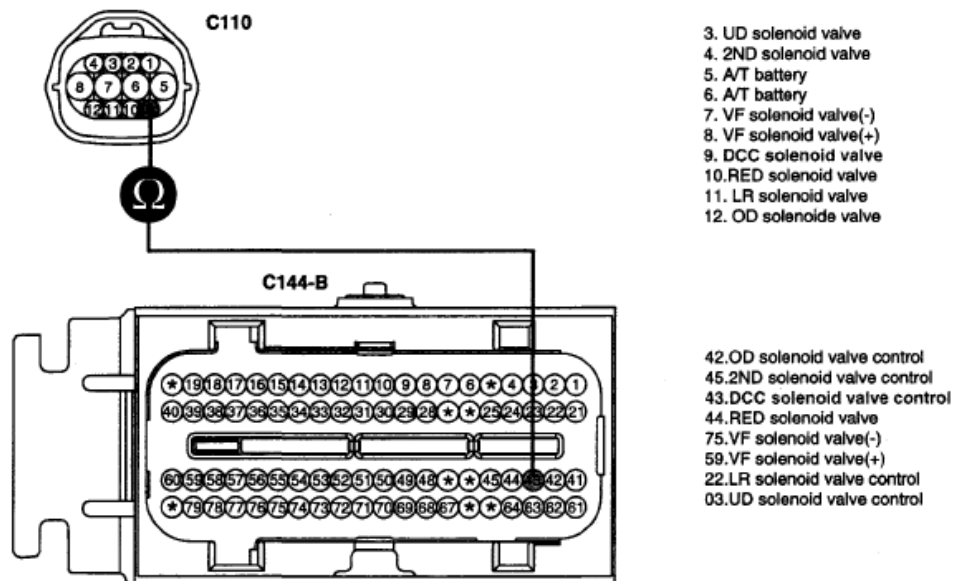
SIGNAL WAVEFORM

Refer to **DTC P0731**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR (PG-A), OUTPUT SPEED SENSOR (PG-B), GEAR POSITION" parameter on the scantool.
4. Perform the "STALL TEST" at gear position "2"

Specification: 2400-2800 engine RPM



EKBF115D

Fig. 89: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	owe	B1	B2
P	-	Neutral	Possible	o						
R	-	Reverse			o					
N	-	Neutral	Possible							o
D	ON	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
		4th					o		o	
D	OFF	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			

2	-	1st				o		o		
		2nd				o			o	
L	-	1st				o				o
C1: Front clutch C2: Rear clutch C3: End clutch OWC: One way clutch B1: Kickdown brake B2: Low & reverse brake										

Stall test procedure in D2 and reason

Procedure

1. Warm up the engine
2. After positioning the select lever in "D" and "ON" of the HOLD SW.
3. Depress the foot brake pedal fully after that, depress the accelerator pedal to the maximum.

* The slippage of 2nd gear operating parts can be detected by stall test in D2.

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
3. If 1st gear operating part has faults, input speed revolution will be out of specification.
4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES : --> Go to **SIGNAL CIRCUIT INSPECTION** procedure.

NO : --> Go to "**COMPONENT INSPECTION**" procedure.

CAUTION:

- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature: 176 °F~212 °F (80~100 °C).
 - Engine coolant temperature: 176 °F~212 °F (80~100 °C).
- Chock both rear wheel (left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.

- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 RPM to let the A/T fluid cool down before carrying out subsequent test.

* Perform stall test on "L" range If the result of stall test on "D" range is out of specifications.

"One Way Clutch" is faulty If the result of stall test on "L" range is within specifications.

SIGNAL CIRCUIT INSPECTION

1. Connect Scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the engine speed until about 2000 RPM in the 2nd gear while driving the vehicle on a level road.

Specification: $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{GEAR RATIO}) < \text{or} = 200 \text{ RPM}$

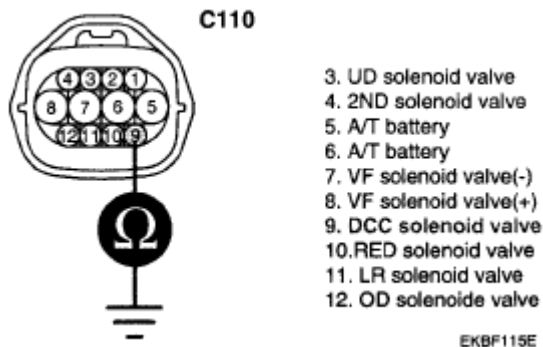


Fig. 90: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES : --> Go to "COMPONENT INSPECTION" procedure.

NO : --> Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "VERIFICATION OF VEHICLE REPAIR" procedure.

COMPONENT INSPECTION

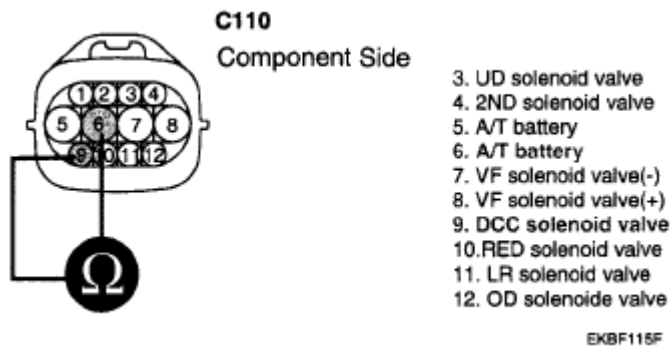


Fig. 91: Identifying Pressure Ports
Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "R/C" and "K/D" port.
2. Engine "ON".
3. Drive a car at gear position 2 in "D RANGE".
4. Compare actual value to specifications.

Specification: Shown below

HYDRAULIC PRESSURE - MEASUREMENT CONDITION

No.	Measurement Condition			Standard hydraulic pressure kpa (kg/cm ² psi)						
	Select lever position	Engine speed (rpm)	Shift position	1	2	3	4	5	6	7
				Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-
				402~422		844~883			343~520	422~480

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5	L	1,000	1st gear	(4.1~4.3, 58~61)	-	(8.6~9.0, 122~128)	-	-	(3.5~5.3, 50~75)	(4.3~4.9, 61~70)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)

NOTE:

- "-" is 0.2 (0.3)kg/cm² or less and "()" is the reverse.
- **SW-ON:** Turn the overdrive control switch ON.
- **SW-OFF:** Turn the overdrive control switch OFF.
- The hydraulic pressure may be more than standard value at the ambient temperature.

* The values are subject to change according to vehicle model or condition

5. Is oil pressure value within specification?

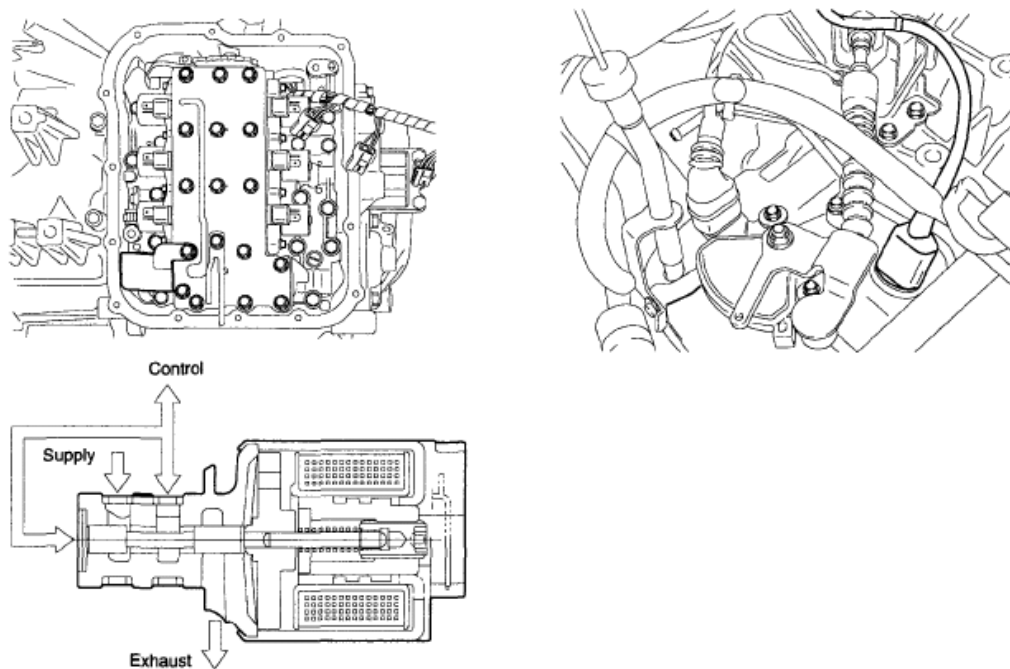
YES : --> Repair AUTO TRANSAXLE (Clutch or brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0733 GEAR 3 INCORRECT RATIO**COMPONENT LOCATION**



EKBF116G

Fig. 92: Identifying Gear 3 Incorrect Ratio Component Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 3rd gear ratio, while the transaxle is engaged in the 3rd gear. For example, if the input speed is 1000 RPM and the 3rd gear ratio is 1.000, then the output speed is approx. 1000 RPM.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 3rd gear ratio, while the transaxle is engaged in 3rd gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	3rd gear incorrect ratio	- Faulty input speed sensor - Faulty output speed sensor - Faulty R/D or F/C or E/C
Enable Conditions	- Engine speed > 400rpm - Output speed (PG-B) > 600rpm - Shift stage 3rd gear - Input speed (PG-A) > 300rpm	

F/C-Front Clutch
 R/C - Rear Clutch

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	• A/T fluid temp. > -10°C (14°F) • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	E/C - End Clutch OWC - One Way Clutch K/B - Kickdown brake L/R - Low & Reverse brake
Threshold Value	• Input speed/3rd gear ratio - output speed > or = 200rpm / 3rd gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0733 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

Refer to **DTC P0731**.

SIGNAL WAVEFORM

Refer to **DTC P0731**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "ENGINE SPEED, INPUT SPEED SENSOR (PG-A), OUTPUT SPEED SENSOR (PG-B), GEAR POSITION" parameter on the scantool.
4. Disconnect the solenoid valve connector and perform the "STALL TEST".

Specification: 2400~2800 engine RPM

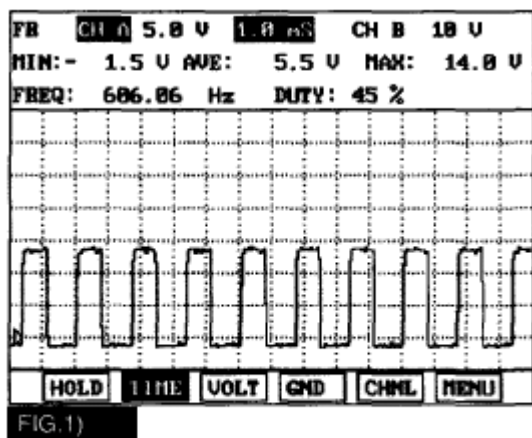


FIG.1) : Wave form of "VFS"

EKBF116A

Fig. 93: Scantool Data - Screen Display

Courtesy of KIA MOTORS AMERICA, INC.

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	o						
R	-	Reverse			o					
N	-	Neutral	Possible							o
D	ON	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
		4th					o		o	
D	OFF	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
2	-	1st				o		o		
		2nd				o			o	
L	-	1st				o				o

C1: Front clutch

C2: Rear clutch

C3: End clutch

OWC: One way clutch

B1: Kickdown brake

B2: Low & reverse brake

Stall test procedure in D3 and reason

Procedure

1. Warm up the engine
2. Set 3rd gear hold by disconnecting the solenoid valve connector. Fully depress the brake pedal, then place the transaxle gear lever into "D" range. Press and hold the accelerator pedal to the floor for no more than eight seconds while observing the engine, input speed, and output speed RPM values.

* The slippage of 3rd gear operating parts can be detected by stall test in D3.

Reason for stall test

1. If there is no mechanical defaults in A/T, all slippage occurs in torque converter.
 2. Therefore, engine revolution is output, but input and output speed revolution must be "zero" due to wheel's lock.
 3. If 1st gear operating part has faults, input speed revolution will be out of specification.
 4. If output speed revolution is output. It means that the foot brake force is not applied fully. Remeasuring is required.
5. Is "STALL TEST" within specification?

YES : --> Go to **SIGNAL CIRCUIT INSPECTION** procedure.

NO : --> Go to "**COMPONENT INSPECTION**" procedure.

CAUTION:

- Do not let anybody stand in front of or behind the vehicle while this test is being carried out.
- Check the A/T fluid level and temperature and the engine coolant temperature.
 - Fluid level: At the hot mark on the oil level gauge.
 - Fluid temperature: 176 °F~212 °F (80~100 °C).
 - Engine coolant temperature: 176 °F~212 °F (80~100 °C).
- Chock both rear wheel (left and right).
- Pull the parking brake lever on with the brake pedal fully depressed.
- The throttle should not be left fully open for more than eight seconds.
- If carrying out the stall test two or more times, move the select lever to the "N" position and run the engine at 1,000 RPM to let the A/T fluid cool down before carrying out subsequent test.

SIGNAL CIRCUIT INSPECTION

1. Connect scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the Engine speed until about 2000 RPM in the 3rd gear while driving the vehicle on a level

road.

Specification: $\text{INPUT SPEED} - (\text{OUTPUT SPEED} \times \text{GEAR RATIO}) < \text{or} = 200 \text{ RPM}$

1.2 CURRENT DATA 13/27		1.2 CURRENT DATA 13/27	
× PRESSURE SOLENOID	98 %	× PRESSURE SOLENOID	8 %
× SHIFT POSITION	-	× SHIFT POSITION	-
× SELECT LEVER SW.	D	× SELECT LEVER SW.	P,N
LR SOLENOID DUTY	99 %	LR SOLENOID DUTY	99 %
UD SOLENOID DUTY	8 %	UD SOLENOID DUTY	8 %
2ND SOLENOID DUTY	8 %	2ND SOLENOID DUTY	8 %
OD SOLENOID DUTY	8 %	OD SOLENOID DUTY	8 %
RED SOLENOID DUTY	99 %	RED SOLENOID DUTY	99 %
FIX	SCRN	FULL	PART
GRPH	HELP	GRPH	HELP

FIG.1)

FIG.2)

1.2 CURRENT DATA 13/27		1.2 CURRENT DATA 13/27	
× PRESSURE SOLENOID	99 %	× PRESSURE SOLENOID	35 %
× SHIFT POSITION	1ST GEAR	× SHIFT POSITION	2ND GEAR
× SELECT LEVER SW.	D	× SELECT LEVER SW.	D
LR SOLENOID DUTY	99 %	LR SOLENOID DUTY	8 %
UD SOLENOID DUTY	99 %	UD SOLENOID DUTY	99 %
2ND SOLENOID DUTY	8 %	2ND SOLENOID DUTY	99 %
OD SOLENOID DUTY	8 %	OD SOLENOID DUTY	8 %
RED SOLENOID DUTY	99 %	RED SOLENOID DUTY	99 %
FIX	SCRN	FULL	PART
GRPH	HELP	GRPH	HELP

FIG.3)

FIG.4)

1.2 CURRENT DATA 13/27		1.2 CURRENT DATA 13/27	
× PRESSURE SOLENOID	35 %	× PRESSURE SOLENOID	35 %
× SHIFT POSITION	3RD GEAR	× SHIFT POSITION	4TH GEAR
× SELECT LEVER SW.	D	× SELECT LEVER SW.	D
LR SOLENOID DUTY	8 %	LR SOLENOID DUTY	8 %
UD SOLENOID DUTY	99 %	UD SOLENOID DUTY	8 %
2ND SOLENOID DUTY	8 %	2ND SOLENOID DUTY	99 %
OD SOLENOID DUTY	99 %	OD SOLENOID DUTY	99 %
RED SOLENOID DUTY	99 %	RED SOLENOID DUTY	99 %
FIX	SCRN	FULL	PART
GRPH	HELP	GRPH	HELP

FIG.5)

FIG.6)

1.2 CURRENT DATA 13/27	
× PRESSURE SOLENOID	72 %
× SHIFT POSITION	5TH GEAR
× SELECT LEVER SW.	D
LR SOLENOID DUTY	99 %
UD SOLENOID DUTY	8 %
2ND SOLENOID DUTY	99 %
OD SOLENOID DUTY	99 %
RED SOLENOID DUTY	8 %
FIX	SCRN
FULL	PART
GRPH	HELP

FIG.7)

FIG. 1) "R"
 FIG. 2) P,N
 FIG. 3) "D 1st" gear
 FIG. 4) "2nd" gear
 FIG. 5) "3rd" gear
 FIG. 6) "4th" gear
 FIG. 7) "5th" gear

EKBF1168

Fig. 94: Output Speed Sensors - Screen Display
 Courtesy of KIA MOTORS AMERICA, INC.

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

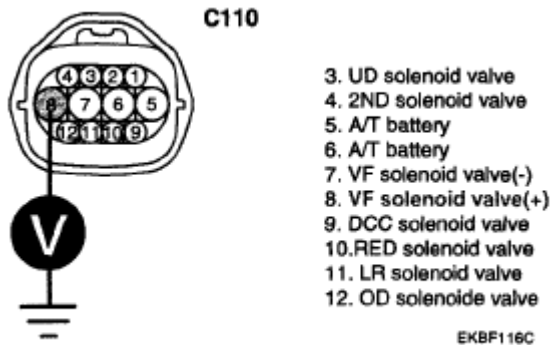


Fig. 95: Identifying Low And Reverse Pressure Component Location
Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "E/C" and "R/C" and "F/C" port.
2. Engine "ON".
3. Disconnect the solenoid valve connector.
4. Drive a car at gear position 3 in "D RANGE".
5. Compare actual value to specifications.

Specification: Shown below

HYDRAULIC PRESSURE - MEASUREMENT CONDITION

No.	Measurement Condition			Standard hydraulic pressure kpa (kg/cm ² , psl)						
	Select lever position	Engine speed (rpm)	Shift position	1	2	3	4	5	6	7
				Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure
1	N	Idling	Neutral	402-422 (4.1-4.3, 58-61)	-	-	-	-	-	-
	D			402~422	853~893			834~873		

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2	(switch ON)	2,500	4th gear	(4.1~4.3, 58~61)	(8.7~9.1, 124~129)	-	-	(8.5~8.9, 121~127)	-	-
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-
5	L	1,000	1st gear	402~422 (4.1~4.3, 58~61)	-	844~883 (8.6~9.0, 122~128)	-	-	343~520 (3.5~5.3, 50~75)	422~480 (4.3~4.9, 61~70)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)

NOTE:

- "-" is 0.2 (0.3)kg/cm² or less and "()" is the reverse.
- SW-ON: Turn the overdrive control switch ON.
- SW-OFF: Turn the overdrive control switch OFF.
- The hydraulic pressure may be more than standard value at the ambient temperature.

* The values are subject to change according to vehicle model or condition

6. Is oil pressure value within specifications?

YES : --> Repair AUTO TRANSAXLE (Clutch or brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

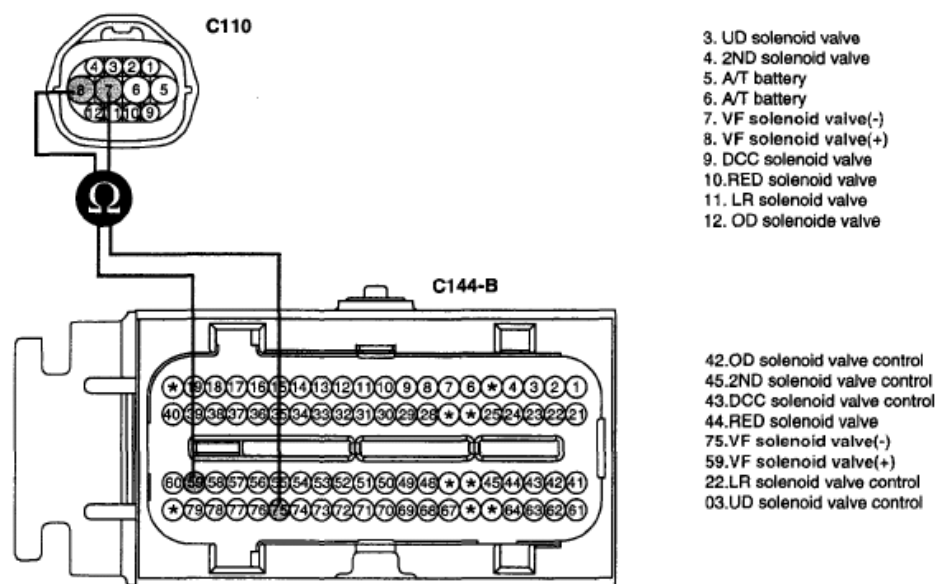
NO : --> Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0734 GEAR 4 INCORRECT RATIO

COMPONENT LOCATION



EKBF116D

Fig. 96: Identifying Gear 3 Incorrect Ratio Component Location
Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The value of the input shaft speed should be equal to the value of the output shaft speed, when multiplied by the 4th gear ratio, while the transaxle is engaged in the 4th gear. For example, if the input speed is 1000 RPM and the 4th gear ratio is 0.685, then the output speed is 685 RPM.

DTC DESCRIPTION

This code is set if the value of input shaft speed is not equal to the value of the output shaft, when multiplied by the 4th gear ratio, while the transaxle is engaged in 4th gear. This malfunction is mainly caused by mechanical troubles such as control valve sticking or solenoid valve malfunctioning rather than an electrical issue.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	4th gear incorrect ratio	- Faulty input speed sensor - Faulty output speed sensor - Faulty E/C or K/D
Enable Conditions	- Engine speed > 400rpm - Output speed (PG-B) > 600rpm - Shift stage 4th gear - Input speed (PG-A) > 300rpm - A/T fluid temp. > -10°C (14°	F/C-Front Clutch R/C - Rear Clutch E/C - End Clutch OWC - One Way Clutch

2006 Kia Rio

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	F) • TRANSAXLE RANGE SWITCH is normal • Solenoid is normal	K/B - Kickdown brake L/R - Low & Reverse brake
Threshold Value	• Input speed/4th gear ratio - output speed > or =200rpm / 4th gear ratio	
Diagnostic Time	• More than 1sec	
Fail Safe	• Locked into 3rd gear. (If diagnosis code P0734 is output four times, the transaxle is locked into 3rd gear)	

SCHEMATIC DIAGRAM

Refer to **DTC P0731**.

SIGNAL WAVEFORM

Refer to **DTC P0731**.

MONITOR SCANTOOL DATA

* It is difficult to "STALL TEST" in 4th gear, therefore Go to **SIGNAL CIRCUIT INSPECTION** procedure.

OPERATING ELEMENT OF EACH SHIFTING RANGE

OPERATING ELEMENT OF EACH SHIFTING RANGE

Selector lever position	Overdrive control switch	Shifting gear	Engine start	Parking Mechanism	Clutch				Brake	
					C1	C2	C3	OWC	B1	B2
P	-	Neutral	Possible	o						
R	-	Reverse			o					
N	-	Neutral	Possible							o
D	ON	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
		4th					o		o	
D	OFF	1st				o		o		
		2nd				o			o	
		3rd			o	o	o			
		1st				o		o		

2	-	2nd				o			o	
L	-	1st				o				o
C1: Front clutch C2: Rear clutch C3: End clutch OWC: One way clutch B1: Kickdown brake B2: Low & reverse brake										

SIGNAL CIRCUIT INSPECTION

1. Connect scantool.
2. Engine "ON".
3. Monitor the "INPUT & OUTPUT SPEED SENSOR" parameter on the scantool.
4. Accelerate the engine speed until about 2000 RPM in the 4th gear while driving the vehicle on a level road.

Specification: INPUT SPEED - (OUTPUT SPEED x GEAR RATIO) < or = 200 RPM

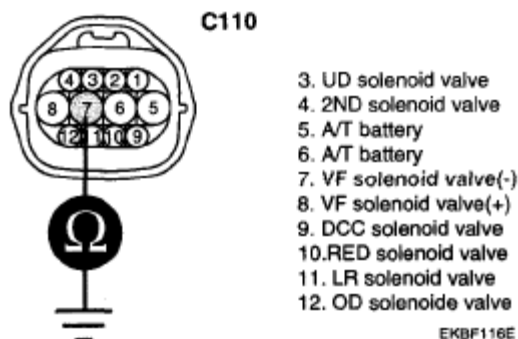


Fig. 97: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Are "INPUT & OUTPUT SPEED SENSOR" within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for electrical noise of circuit in INPUT & OUTPUT SPEED SENSOR or Replace INPUT & OUTPUT SPEED SENSOR. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

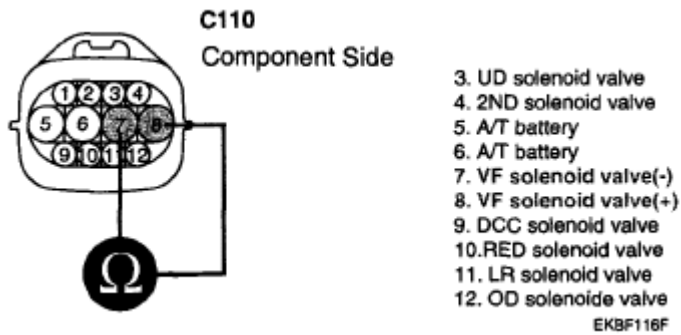


Fig. 98: Identifying Low And Reverse Pressure Component Location
Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "E/C" and "K/D" port.
2. Engine "ON".
3. Drive a car at gear position "4" in "D RANGE".
4. Compare actual value to specifications.

Specification: Shown below

HYDRAULIC PRESSURE - MEASUREMENT CONDITION

No.	Measurement Condition			Standard hydraulic pressure kpa (kg/cm ² , psi)						
	Select lever position	Engine speed (rpm)	Shift position	1	2	3	4	5	6	7
				Reduction pressure	Servo apply pressure	Rear clutch pressure	Front clutch pressure	End clutch pressure	Low & reverse brake pressure	Torque converter pressure
1	N	Idling	Neutral	402~422 (4.1~4.3, 58~61)	-	-	-	-	-	-
2	D (switch ON)	2,500	4th gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	-	-	834~873 (8.5~8.9, 121~127)	-	-
3	D	2,500	3rd gear	402~422 (4.1~4.3, 58~61)	844~883 (8.6~9.0, 122~128)	844~883 (8.6~9.0, 122~128)	824~863 (8.4~8.8, 119~125)	844~883 (8.6~9.1, 122~128)	-	-
4	D	2,500	2nd gear	402~422 (4.1~4.3, 58~61)	853~893 (8.7~9.1, 124~129)	844~883 (8.6~9.0, 122~128)	-	-	-	-
				402~422		844~883			343~520	422~480

5	L	1,000	1st gear	(4.1~4.3, 58~61)	-	(8.6~9.0, 122~128)	-	-	(3.5~5.3, 50~75)	(4.3~4.9, 61~70)
6	R	2,500	Reverse	441~461 (4.5~4.7, 64~67)	-	-	1815~1913 (18.5~19.5, 263~277)	-	1815~1913 (18.5~19.5, 263~277)	432~490 (4.4~5.0, 63~71)

NOTE:

- "-" is 0.2 (0.3)kg/cm² or less and "()" is the reverse.
- **SW-ON:** Turn the overdrive control switch ON.
- **SW-OFF:** Turn the overdrive control switch OFF.
- The hydraulic pressure may be more than standard value at the ambient temperature.

* The values are subject to change according to vehicle model or condition

5. Is oil pressure value within specifications?

YES : --> Repair AUTO TRANSAXLE (Clutch or brake) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

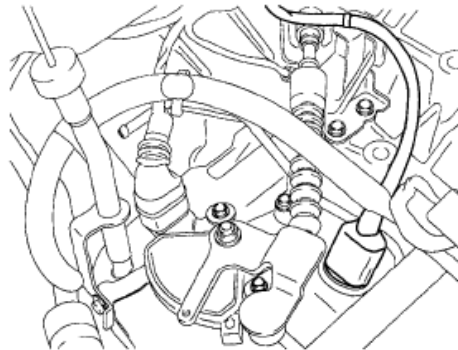
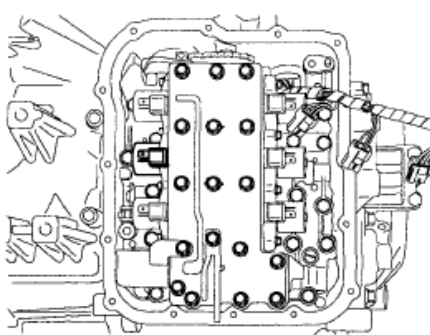
NO : --> Replace AUTO TRANSAXLE (BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0731**.

DTC P0741 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK OFF

COMPONENT LOCATION



KKCF213G

Fig. 99: Identifying Torque Converter Component Location

Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The PCM controls the locking and unlocking of the Torque Converter Clutch (or Damper Clutch), to the input shaft of the transmission, by applying hydraulic pressure. The main purpose of T/C clutch control is to save fuel by decreasing the hydraulic load inside the T/C. The PCM outputs duty pulses to control the Damper Clutch Control Solenoid Valve (DCCSV) and hydraulic pressure is applied to the DC according to the DCC duty ratio value. When the duty ratio is high, high pressure is applied and the Damper Clutch is locked. The normal operating range of the Damper Clutch Control duty ratio value is from 30% (unlocked) to 85% (locked).

DTC DESCRIPTION

The PCM increases the duty ratio to engage the Damper Clutch by monitoring slip RPMs (difference value between engine speed and turbine speed). To decrease the slip of the Damper Clutch, the PCM increases the duty ratio by applying more hydraulic pressure. When slip RPM does not drop under specification with 100% duty ratio, the PCM determines that the Torque Converter Clutch is stuck OFF and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Stuck "OFF"	* TORQUE CONVERTER (DAMPER) CLUTCH: TCC - Faulty TCC or oil pressure system - Faulty TCC solenoid valve - Faulty body control valve - Faulty PCM
Enable Conditions	- A/T range switch D,2, L - Solenoid valve status is 100% duty - Input speed (PG-A) 0	
Threshold Value	Calculated slip (engine speed-input speed) > 100rpm (need to verify threshold value)	
Diagnostic Time	More than 10secs	
Fail Safe	Damper clutch abnormal system (If diagnosis code P0741 is output four times, TORQUE CONVERTER (DAMPER) CLUTCH is not controlled by PCM)	

SCHEMATIC DIAGRAM

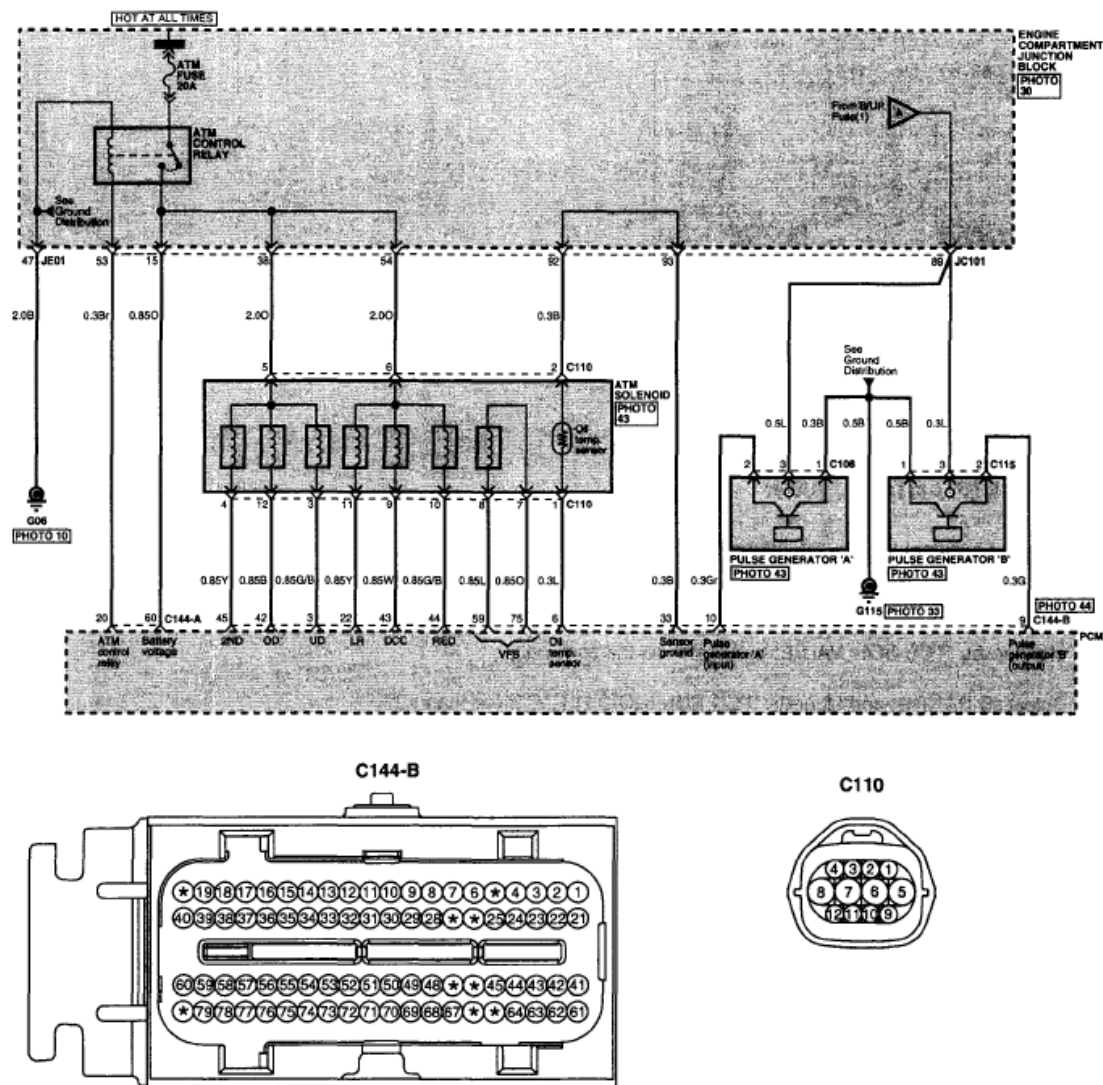


Fig. 100: Schematic Diagram
Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

Specification: TCC SLIP < 100RPM (In condition that TCC SOL. DUTY = 100%)

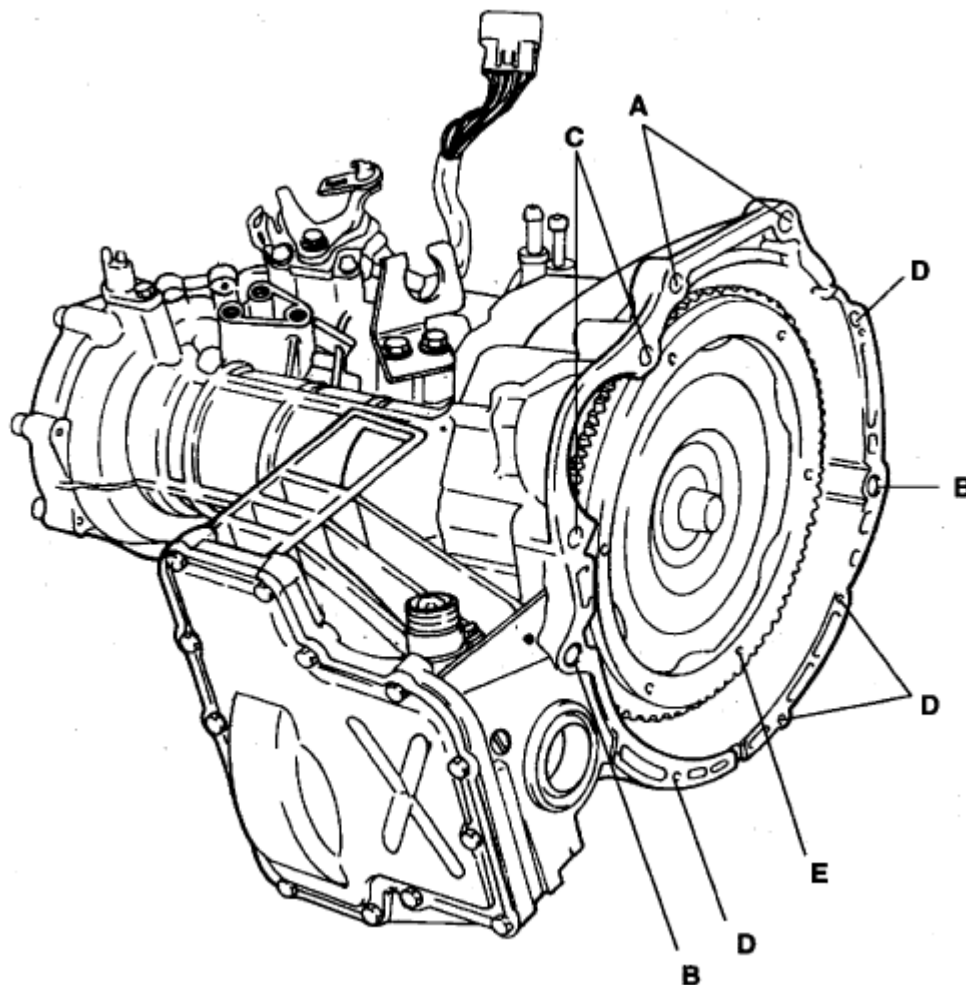


Fig. 101: Scantool Data - Screen Display
 Courtesy of KIA MOTORS AMERICA, INC.

5. Is "TCC SLIP" within specifications?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.

4. Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

YES : --> Go to 2 "CHECK OIL PRESSURE" as below.

NO : --> Repair or replace as necessary and then go to "TCC SOLENOID VALVE" and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

2. CHECK OIL PRESSURE

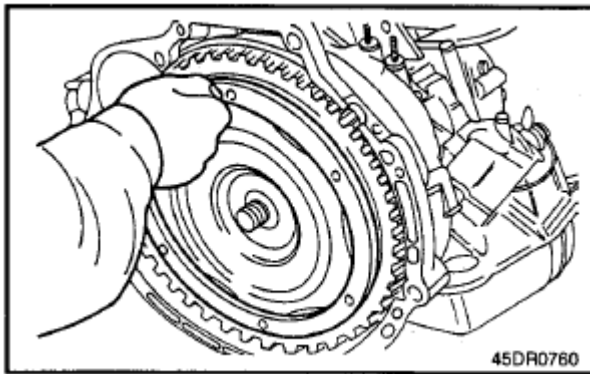


Fig. 102: Identifying Pressure Ports
Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "DA" port.
2. Engine "ON".
3. After connecting scantool and monitor the "TCC SOLENOID VALVE DUTY" parameter on the scantool data list.
4. Operate vehicle with 3rd or 4th gear and operate the "TCC SOLENOID VALVE DUTY" more than 40%.
5. Measure oil pressure.

Specification: approx. 637~686Kpa (6.4~7.0kg/cm²) - (In condition that TCC SOL. DUTY > 40%)

6. Is oil pressure value within specification?

YES : --> Repair TORQUE CONVERTER CLUTCH (REPLACE Torque Converter) as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Replace A/T assy (possible to BODY CONTROL VALVE faulty) as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC enable conditions in general information.
4. Are any DTCs present ?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

DTC P0742 TORQUE CONVERTER CLUTCH CIRCUIT - STUCK ON

COMPONENT LOCATION

Refer to **DTC P0741**.

GENERAL DESCRIPTION

Refer to **DTC P0741**.

DTC DESCRIPTION

The PCM increases duty ratio, to engage the Damper Clutch, by monitoring slip RPMs. (difference in value between engine speed and turbine speed). However, If a very small amount of slip RPM is maintained, the PCM applies 0% duty ratio value, then the PCM judges that the Torque Converter Clutch is stuck ON and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Stuck "ON"	* TORQUE CONVERTER (DAMPER) CLUTCH: TCC • Faulty TCC or oil pressure system • Faulty TCC solenoid valve • Faulty body control valve • Faulty PCM
Enable Conditions	• Solenoid valve status is 0% duty • Throttle position > or = 20% • Engine speed > 0 rpm • Output speed (PG-B) > 1000rpm • A/T range switch D,2, L • -10°C (14°F) < A/T fluid temperature > 130°C (266°F)	
Threshold Value	• Calculated slip: engine speed-input speed < 5rpm	
Diagnostic Time	• More than 3 sees	

Fail Safe

- Damper clutch abnormal system (If diagnosis code P0742 is output four times, TORQUE CONVERTER (DAMPER) CLUTCH is not controlled by PCM)

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Select "D RANGE" and drive vehicle.
4. Monitor the "TORQUE CONVERTER (DAMPER) CLUTCH" parameter on the scantool.

Specification: TCC SLIP > 5RPM > or = (In condition that TCC SOL. DUTY = 0%)

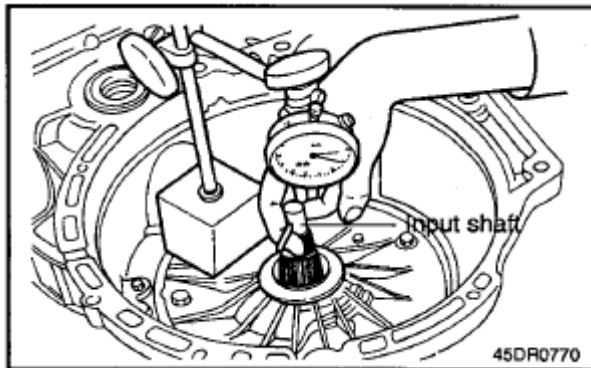


Fig. 103: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Is "TCC SLIP" within specifications?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**COMPONENT INSPECTION**" procedure.

COMPONENT INSPECTION

1. CHECK TORQUE CONVERTER CLUTCH SOLENOID VALVE

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating tone for using TCC SOLENOID VALVE actuator testing function?

YES : --> Go to 2 "CHECK OIL PRESSURE" as below.

NO : --> Repair or replace as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK OIL PRESSURE

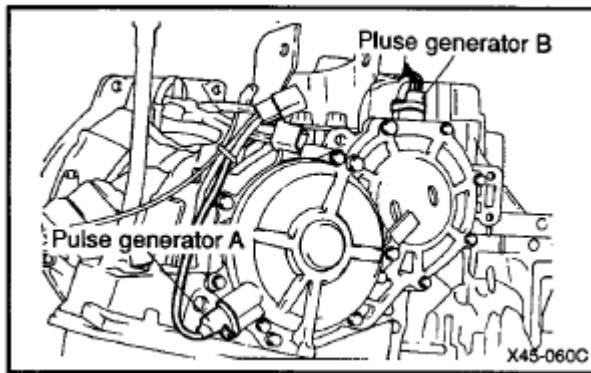


Fig. 104: Identifying Damper Clutch Supply Pressure, Rear Clutch And Front Clutch Component Location

Courtesy of KIA MOTORS AMERICA, INC.

1. Connect oil pressure gauge to "DR" port.
2. Ignition "ON" & Engine "OFF".
3. After connecting scantool and monitor the TCC SOLENOID VALVE DUTY" parameter on the scantool data list.
4. Select 1st gear and accelerate engine speed to 2500 RPM.
5. Measure oil pressure.

Specification: approx. 235~274Kpa (2.4~2.8kg/cm²) > or = (In condition that TCC SOL. DUTY = 0%)

6. Is oil pressure value within specification?

YES : --> Repair TORQUE CONVERTER CLUTCH (REPLACE Torque Converter) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace A/T assy (possible to BODY CONTROL VALVE faulty) as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

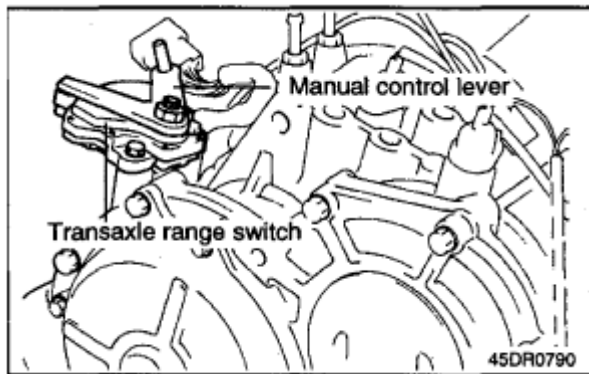
DTC P0743 TORQUE CONVERTER CLUTCH CIRCUIT - ELECTRICAL**COMPONENT LOCATION**

Fig. 105: Identifying Torque Converter Clutch Connector Component Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

Refer to **DTC P0741**.

DTC DESCRIPTION

The PCM checks the Damper Clutch Control Signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored (for example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM judges that DCCSV circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check voltage range	* TORQUE CONVERTER (DAMPER) CLUTCH: TCC * PWM: Pulse Width Modulation - Open or short in circuit - Faulty TCC SOLENOID VALVE - Faulty PCM
Enable Conditions	25% < PWM duty < 100% 8V < Battery voltage < 16V	
Threshold Value	- The circuit is short in condition of the Max. of the feedback voltage > 3.999V - The circuit is open in condition of the Max. of the	

	feedback voltage < 0.0977V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Lock-up control is prohibited	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

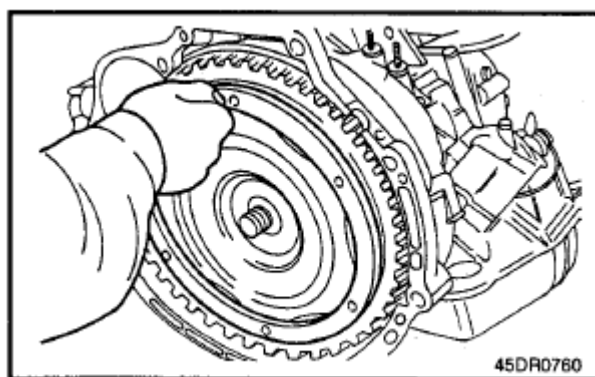
SIGNAL WAVEFORM

Fig. 106: Signal Waveform Graph
Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "TCC SOL. VALVE" parameter on the scantool.
4. Select "D RANGE" and operate the vehicle.
5. Check "TCC SOL. VALVE" parameter value changes while driving.

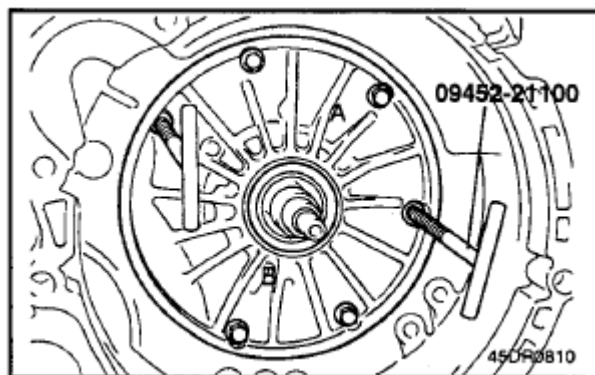


Fig. 107: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

6. Does "TCC SOLENOID DUTY" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES : --> Repair as necessary and then go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "1" of the sensor harness connector and chassis ground.

Specification: approx. 6V

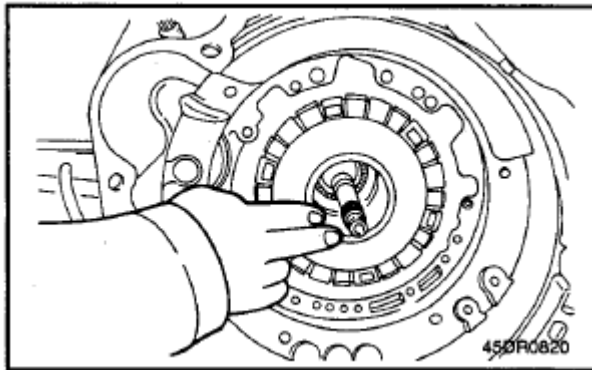


Fig. 108: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE

1. Ignition "OFF".
2. Disconnect "A/T SOLENOID VALVE" connector.
3. Measure resistance between terminal "1" and chassis ground.

Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

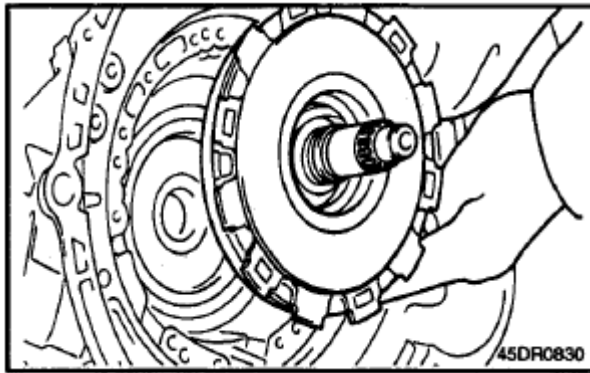


Fig. 109: Measuring Resistance Between Terminal And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace TCC SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for TCC SOLENOID VALVE actuator testing function?

YES : --> Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace PCM as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0 mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0745 PRESSURE CONTROL SOLENOID VALVE A

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Pressure Control Solenoid Valve A (PCSV A) converts the electric signals, which are controlled by the PCM, into hydraulic pressure. The PCSV A controls the hydraulic pressure, which is applied to the Clutches and Brakes, to reduce the shift shock during shifting.

DTC DESCRIPTION

The PCM checks the Pressure Control Solenoid Valve signals by monitoring the feedback signals from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM judges that the PCSV A drive circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	* PWM: Pulse Width Modulation • Open or short in circuit • Faulty PCSV-A
Enable Conditions	• 25% < PWM duty < 100% • 8V < Battery voltage < 16V	

Threshold Value	• The circuit is open in condition of the Max. of feedback voltage > 3.999V • The circuit is short in condition of the Max. of feedback voltage < 0.097V	• Faulty PCM
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

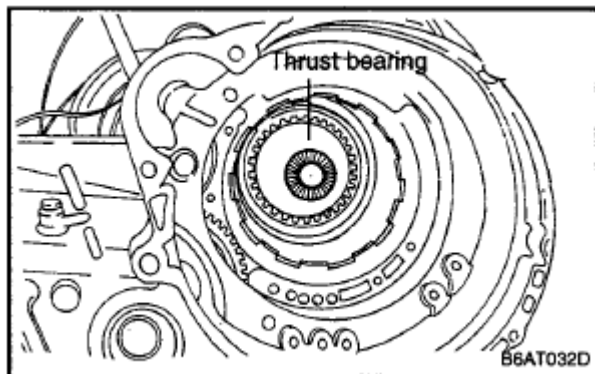
SIGNAL WAVEFORM

Fig. 110: Signal Waveform Graph

Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "PCSV-A" parameter on the scantool.
4. Select "N --> D RANGE".
5. Check "PCSV-A" parameter value changes while driving.

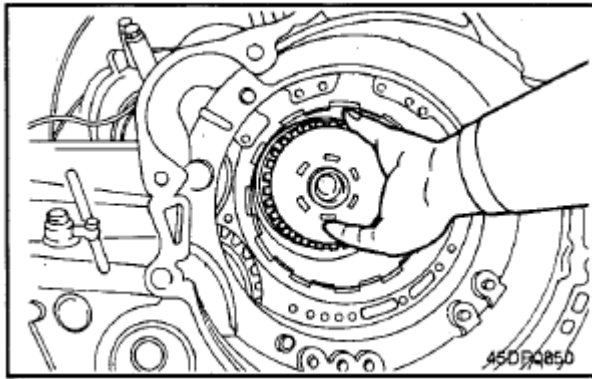


Fig. 111: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

6. Does "PCSV-A DUTY" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Go to **"TERMINAL & CONNECTOR INSPECTION"** procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "5" of the sensor harness connector and chassis ground.

Specification: approx. 6V

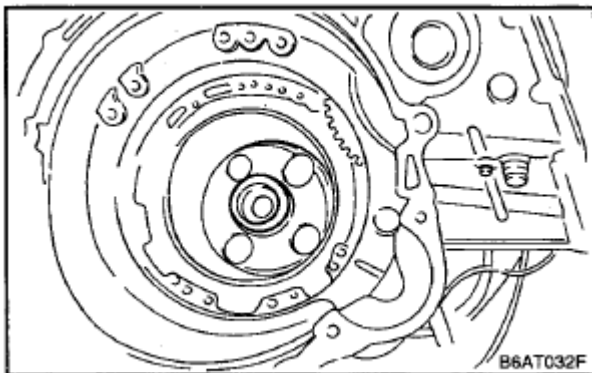


Fig. 112: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE

1. Ignition "OFF".
2. Disconnect "A/T SOLENOID VALVE" connector.
3. Measure resistance between terminal "5" and chassis ground.

Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

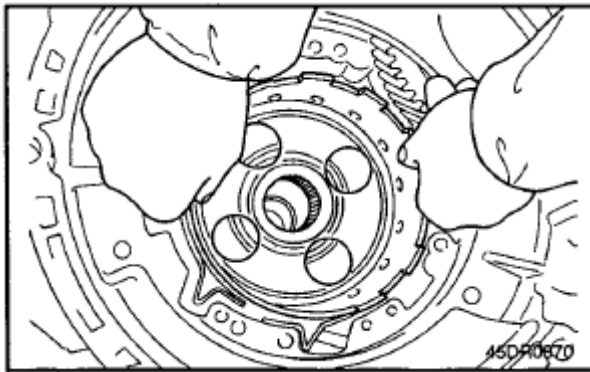


Fig. 113: Measuring Resistance Between Terminal "5" And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace TCC SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".

3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES : --> Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace PCM as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0 mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0750 SHIFT CONTROL SOLENOID VALVE A CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A, SCSV B, SCSV C).

DTC DESCRIPTION

The PCM checks the Shift Control Solenoid Valve A control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM judges that SCSV A control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty SCSV-A • Faulty PCM
Enable Conditions	• Solenoid is turned ON and circuit is short • Solenoid is turned OFF and circuit is open • Voltage of battery > 9V	
Threshold Value	• The circuit is open in condition of the feedback voltage > 1.01V • The circuit is short in condition of the feedback voltage < 1.001V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Measure voltage between terminal "2" of the sensor harness connector and chassis ground.
4. Select "N --> D RANGE".

Specification: "N" Range - 0V, "D 1" Range - 12V.

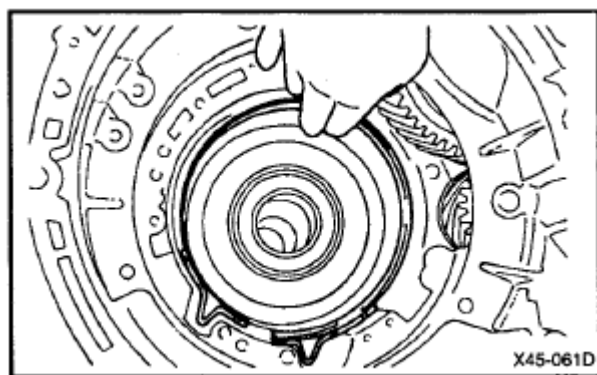


Fig. 114: Scantool Display - N And D Range
 Courtesy of KIA MOTORS AMERICA, INC.

5. Is "SCSV-A" within the specifications?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Go to **"TERMINAL & CONNECTOR INSPECTION"** procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "2" of the sensor harness connector and chassis ground.

Specification: approx. 12V

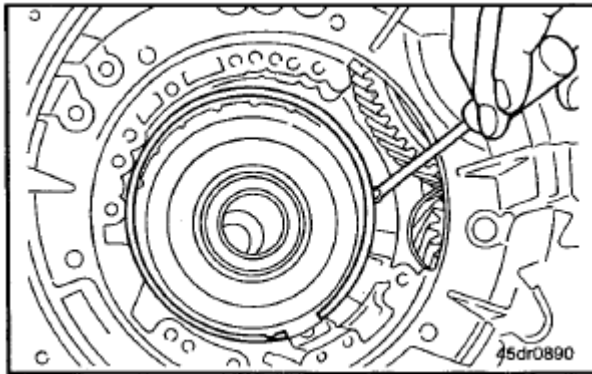


Fig. 115: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to **"COMPONENT INSPECTION"** procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE

1. Ignition "OFF".
2. Disconnect "A/T SOLENOID VALVE" connector.
3. Measure resistance between terminal "2" and chassis ground.

Specification: Approximately 22.3 ± 1.5 ohms [20°C (68°F)]

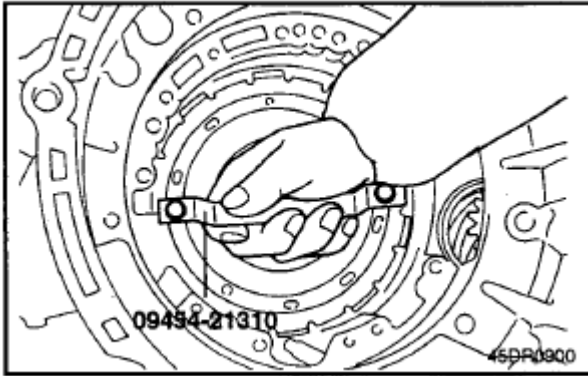


Fig. 116: Measuring Resistance Between Terminal And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace SHIFT CONTROL SOLENOID VALVE-A as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES : --> Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Replace PCM as necessary and Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE

4. Vehicle speed 0 (mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0755 SHIFT CONTROL SOLENOID VALVE B CIRCUIT MALFUNCTION**COMPONENT LOCATION**

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A, SCSV B, SCSV C).

DTC DESCRIPTION

The PCM checks the Shift Control Solenoid Valve B control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM judges that SCSV B control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check voltage range	• Open or short in circuit • Faulty SCSV-B • Faulty PCM
Enable Conditions	• Solenoid is turned ON and circuit is short • Solenoid is turned OFF and circuit is open • Voltage of battery > 9V	
Threshold Value	• The circuit is open in condition of the feedback voltage > 1.01V • The circuit is short in condition of the feedback	

	voltage < 1.001V	
Diagnostic Time	• More than 0.3 sec.	
Fail Safe	• Locked in 3rd gear	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Measure voltage between terminal "3" of the sensor harness connector and chassis ground.
4. Shift 2nd --> 3rd.

Specification: "2nd" gear - 12V, "3rd" gear - 0V.

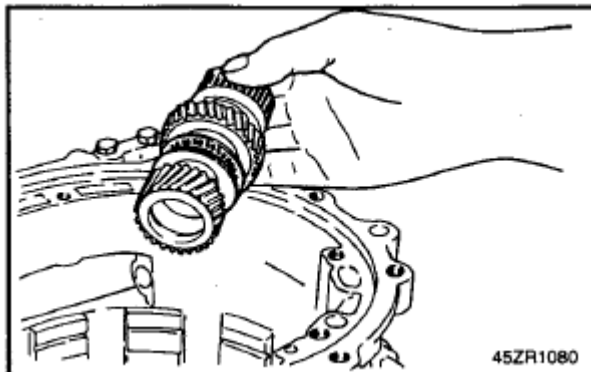


Fig. 117: Scantool Data Display - 2nd Gear And 3rd Gear
Courtesy of KIA MOTORS AMERICA, INC.

5. Is "SCSV-B" within the specifications?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "3" of the sensor harness connector and chassis ground.

Specification: approx. 12V

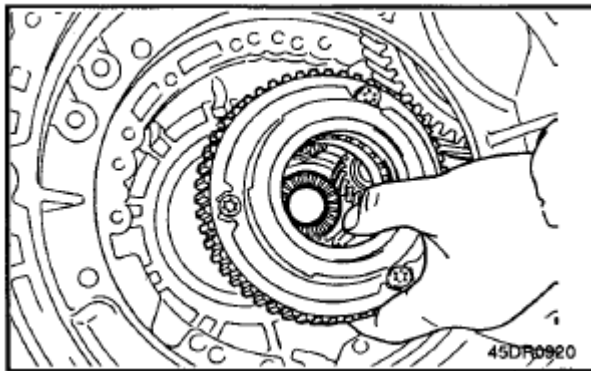


Fig. 118: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE
 1. Ignition "OFF".
 2. Disconnect "A/T SOLENOID VALVE" connector.
 3. Measure resistance between terminal "3" and chassis ground.

Specification: Approximately 22.3 ± 1.5 ohms [20°C (68°F)]

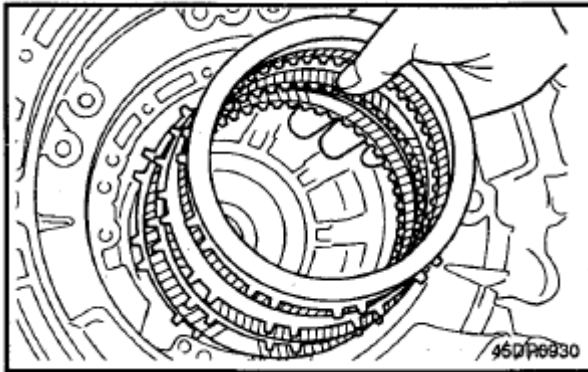


Fig. 119: Measuring Resistance Between Terminal And Chassis Ground
 Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace SHIFT CONTROL SOLENOID VALVE-B as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES : --> Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Replace PCM as necessary and Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0 mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0760 SHIFT CONTROL SOLENOID VALVE C CIRCUIT MALFUNCTION

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Automatic Transmission changes the gear position of the transmission utilizing a combination of Clutches and Brakes, which are controlled by solenoid valves. The New Alpha Automatic Transmission consists of a: LR (Low and Reverse Brake), KD (Kick Down Brake), FC (Front Clutch), RC (Rear Clutch), and EC (End Clutch). The gear position is determined by the combination of 3 kinds of Shift Control Solenoid Valves. (SCSV A, SCSV B, SCSV C).

DTC DESCRIPTION

The PCM checks the Shift Control Solenoid Valve C control signal by monitoring the feedback signal from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected, or low voltage is detected when high voltage is expected) the PCM judges that SCSV C control solenoid circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check voltage range	- Open or short in circuit - Faulty SCSV-C - Faulty PCM
Enable Conditions	- Solenoid is turned ON and circuit is short - Solenoid is turned OFF and circuit is open - Voltage of battery > 9V	
Threshold Value	- The circuit is open in condition of the feedback voltage > 1.01V - The circuit is short in condition of the feedback voltage < 1.001V	
Diagnostic Time	More than 0.3 sec.	
Fail Safe	Locked in 3rd gear	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.
4. Select "N --> D".

Specification: "D" Range 2nd gear-0V, "D" Range 3rd gear-12V.

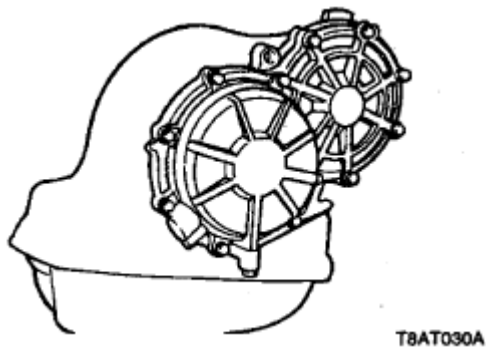


Fig. 120: Scantool Data Display - D Range 2nd Gear And 3rd Gear Range
Courtesy of KIA MOTORS AMERICA, INC.

5. Is "SCSV-C" within the specifications?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "6" of the sensor harness connector and chassis ground.

Specification: approx. 12V

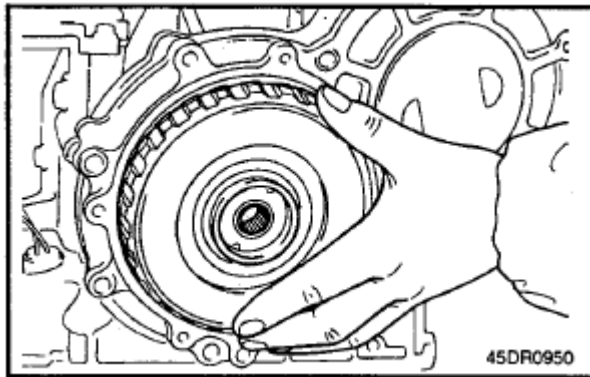


Fig. 121: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE

1. Ignition "OFF".
2. Disconnect "A/T SOLENOID VALVE" connector.
3. Measure resistance between terminal "6" and chassis ground.

Specification: Approximately 22.3 ± 1.5 ohms [20°C (68°F)]

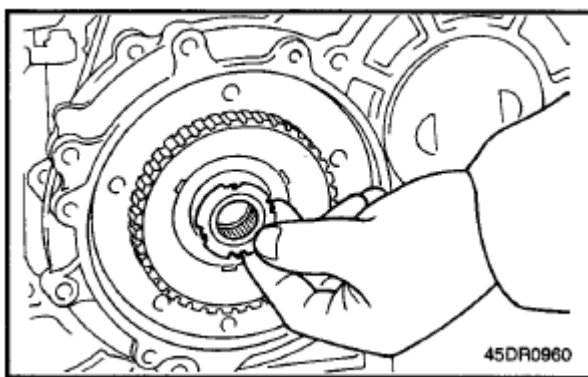


Fig. 122: Measuring Resistance Between Terminal And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace SHIFT CONTROL SOLENOID VALVE-C as necessary and go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for "TCC SOLENOID VALVE" actuator testing function?

YES : --> Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure.

NO : --> Replace PCM as necessary and Go to **"VERIFICATION OF VEHICLE REPAIR"** procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0 mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P0775 PRESSURE CONTROL SOLENOID VALVE B (PCSV-B)

COMPONENT LOCATION

Refer to **DTC P0743**.

GENERAL DESCRIPTION

The Pressure Control Solenoid Valve B (PCSV B) converts the electric signals, which are controlled by the PCM, into hydraulic pressure. The PCSV B is designed to control the Rear Clutch and related skip shift from 4th to 2nd or from 2nd to 4th.

DTC DESCRIPTION

The PCM checks the Pressure Control Solenoid Valve signals by monitoring the feedback signals from the solenoid valve drive circuit. If an unexpected signal is monitored, (For example, high voltage is detected when low voltage is expected or low voltage is detected when high voltage is expected) the PCM judges that the PCSV B drive circuit is malfunctioning and sets this code.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check voltage range	* PWM: Pulse Width Modulation - Open or short in circuit - Faulty PCSV-B - Faulty PCM
Enable Conditions	25% < or = PWM duty < 100% 8V < Battery voltage < 16V	
Threshold Value	- The circuit is open in condition of the Max. of the feedback voltage > 3.999V - The circuit is short in condition of the Max. of the feedback voltage < 0.097V	
Diagnostic Time	More than 0.3 sec.	
Fail Safe	Locked in 3rd gear	

SCHEMATIC DIAGRAM

Refer to **DTC P0741**.

SIGNAL WAVEFORM

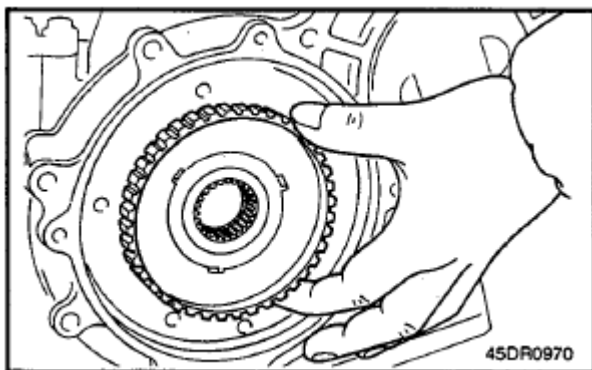


Fig. 123: Signal Waveform Graph
Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).

2. Engine "ON".
3. Monitor the "PCSV-B" parameter on the scantool.
4. Select "D --> N RANGE".
5. Check "PCSV-B" parameter value changes while driving.

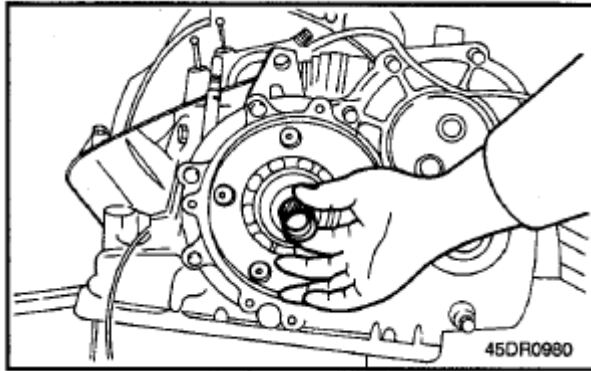


Fig. 124: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

6. Does "PCSV-B DUTY" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

Refer to **DTC P0743**.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "A/T SOLENOID VALVE" connector.
2. IGNITION "ON", ENGINE "OFF".
3. Measure voltage between terminal "4" of the sensor harness connector and chassis ground.

Specification: approx. 6V

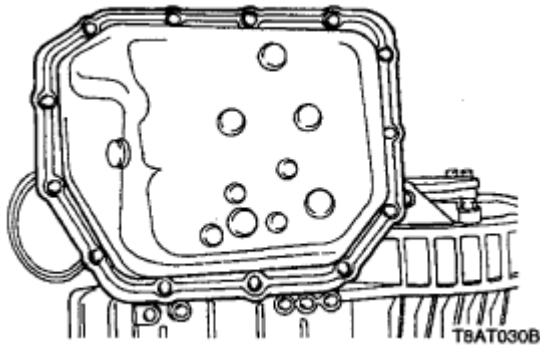


Fig. 125: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Go to step 2 CHECK PCM of the "Component inspection" procedure

COMPONENT INSPECTION

1. CHECK SOLENOID VALVE

1. Ignition "OFF".
2. Disconnect "A/T SOLENOID VALVE" connector.
3. Measure resistance between terminal "4" and chassis ground.

Specification: Approximately 2.7~3.4 ohms [20°C (68°F)]

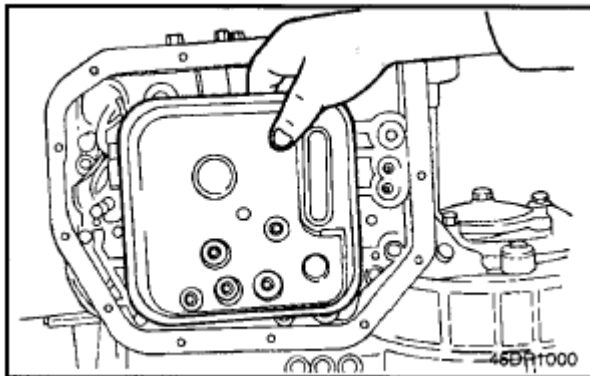


Fig. 126: Measuring Resistance Between Terminal And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is resistance within specification?

YES : --> Go to 2 CHECK PCM as below.

NO : --> Replace TCC SOLENOID VALVE as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. CHECK PCM

1. Connect scantool to data link connector (DLC).
2. Ignition "ON" & Engine "OFF".
3. Select A/T solenoid valve actuator test and operate actuator test.
4. Can you hear operating sound for TCC SOLENOID VALVE actuator testing function?

YES : --> Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Replace PCM as necessary and Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure

ACTUATOR TEST CONDITION

1. IG SWITCH ON
2. TRANSAXLE RANGE SWITCH is normal
3. P RANGE
4. Vehicle speed 0 mph (0 km/h)
5. Throttle position sensor < 1V
6. IDLE SWITCH ON
7. ENGINE RPM 0

VERIFICATION OF VEHICLE REPAIR

Refer to **DTC P0741**.

DTC P1709 KICK DOWN SWITCH

COMPONENT LOCATION

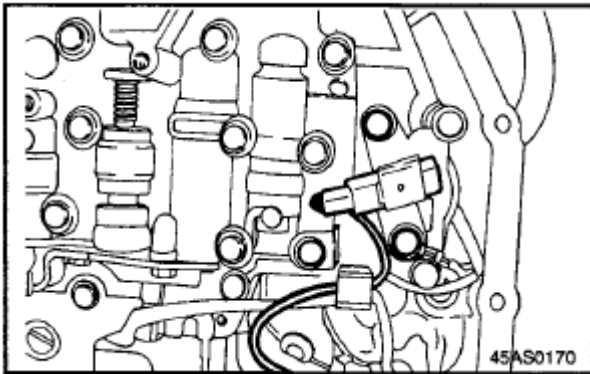


Fig. 127: Identifying Kick Down Switch Component Location
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The KICK DOWN BRAKE is one of the New Alpha automatic transmission's members, which is engaged in the 2nd or 4th gear position, and is released in the 1st or 3rd gear position. The Kick Down Servo switch is installed inside the Kick down brake to provide the optimum hydraulic pressure control by checking the position of the kickdown brake. The Kick Down Servo switch is OFF when the gear is in the 2nd or 4th position, and the switch is ON when the gear is 1st or 3rd position.

DTC DESCRIPTION

The TCM sets this code if the Kick Down Servo switch is ON when the gear is in the 2nd or 4th position, or the switch is OFF when the gear is in the 1st or 3rd position.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item		Detecting Condition & Fail Safe	Possible cause
DTC Strategy		Check voltage range	- Open or short in circuit - Faulty KICK DOWN SERVO SWITCH - Faulty PCM
Enable Conditions		- PG-B >900 Soil temp. > 60°C (140° F) - Inhibitor switch D,2, L - Engine speed > 400rpm - Output speed > 900rpm	
	Case 1	After holding gear position 1 or 3 and continuing 5 sec,	

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Threshold Value	Case 2	SW OFF state
		• After holding gear position 2 or 4 and continuing 5 sec, SW ON state
Diagnostic Time	Case 1	• 1 sec.
	Case 2	• 2 sec.
Fail Safe		• None

SCHEMATIC DIAGRAM

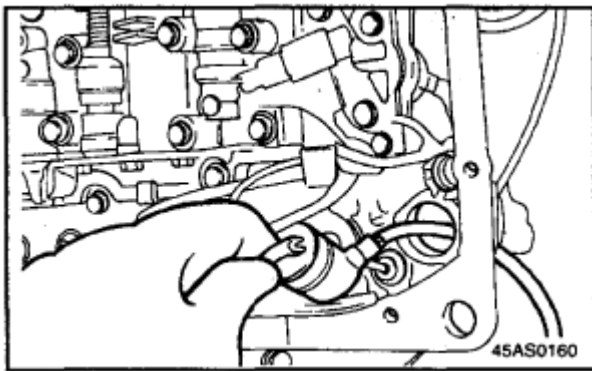


Fig. 128: Schematic Diagram

Courtesy of KIA MOTORS AMERICA, INC.

SIGNAL WAVEFORM

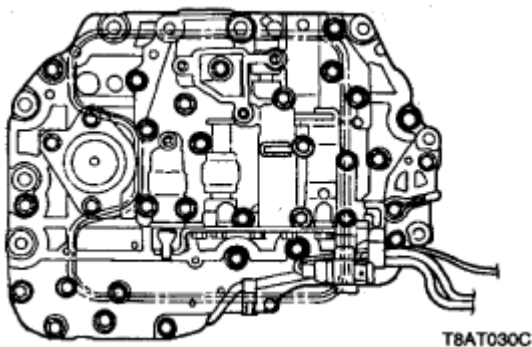


Fig. 129: Signal Waveform Graph

Courtesy of KIA MOTORS AMERICA, INC.

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".

3. Monitor the "K/D SWITCH" parameter on the scantool.
4. Operate the vehicle from "1st" gear to "4th" gear.

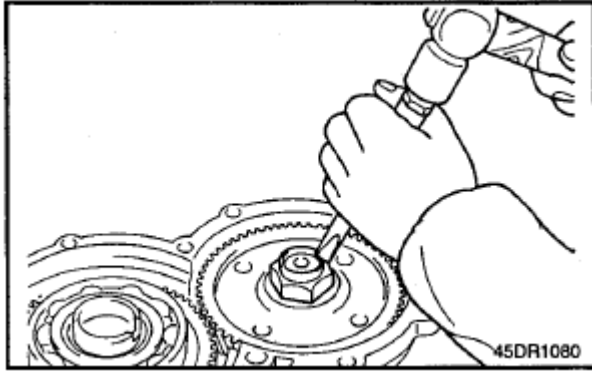


Fig. 130: Scantool Data - Screen Display
Courtesy of KIA MOTORS AMERICA, INC.

5. Does "K/D SWITCH" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or PCM's connector or was repaired and PCM memory was not cleared. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration or damage. Repair or replace as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES : --> Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

SIGNAL CIRCUIT INSPECTION

1. Disconnect "K/D SWITCH" connector.
2. IGNITION "ON", ENGINE "OFF"
3. Measure voltage between terminal "1" of the sensor harness connector and chassis ground.

Specification: Approx. 12 V

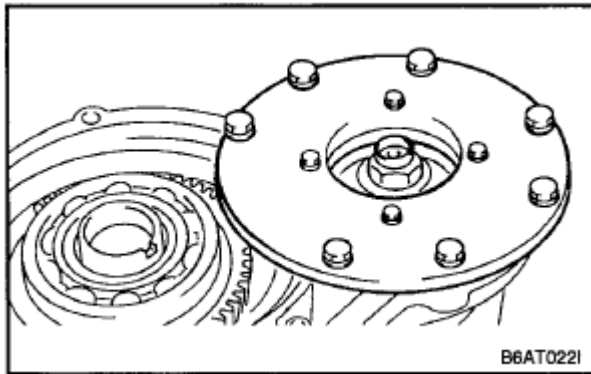


Fig. 131: Measuring Voltage Between Terminal Of Sensor Harness Connector And Chassis Ground
Courtesy of KIA MOTORS AMERICA, INC.

4. Is voltage within specifications?

YES : --> Go to "**COMPONENT INSPECTION**" procedure.

NO : --> Check for open or short in harness. Repair as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

- If signal circuit in harness is OK, Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

COMPONENT INSPECTION

1. CHECK K/D SWITCH

Specification: Connecting the point of contact --> 0ohms, Disconnecting the point of contact --> infinity ohms

1. Is resistance within specifications?

YES : --> Go to 2 KICK DOWN SERVO ADJUSTMENT as below.

NO : --> Replace "K/D SWITCH" as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

2. KICK DOWN SERVO ADJUSTMENT

1. Completely remove all dirt and other contaminating materials adhered around the kickdown adjust screw.
2. Loosen the lock nut.
3. Loosen and tighten the adjust screw (A) two times by torque of 5Nm (3.6lb.ft).

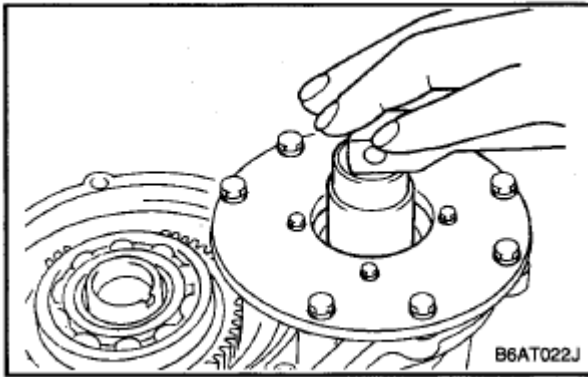


Fig. 132: Identifying Adjust Screw
Courtesy of KIA MOTORS AMERICA, INC.

4. Tighten adjust screw by torque of 5 Nm and then loosen the adjust screw 3 to 3.1/3 turns.
5. Tighten the lock nut to the specified torque.
6. After adjusting, has problem been solved?

YES : --> Go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

NO : --> Substitute with a known-good PCM and check for proper operation. If the problem is corrected, replace PCM as necessary and go to "**VERIFICATION OF VEHICLE REPAIR**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC Enable conditions in general information.
4. Are any DTCs present?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

DTC U0001 CAN COMMUNICATION MALFUNCTION

COMPONENT LOCATION

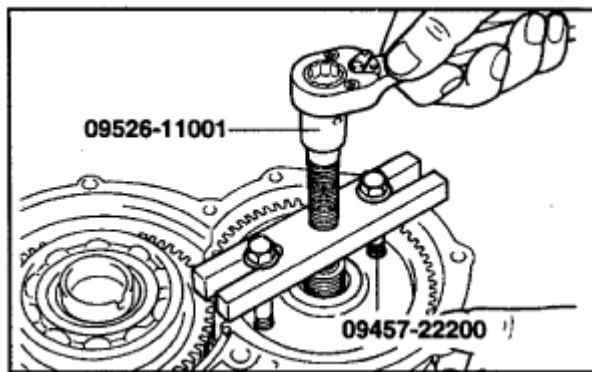


Fig. 133: Identifying Internal Control Module Components
 Courtesy of KIA MOTORS AMERICA, INC.

GENERAL DESCRIPTION

The TCM can either receive data from the Engine Control Module or ABS control module, or it can send data to the ECM and ABSCM by using CAN communication. The CAN communication is one of the vehicle communication methods, which is now widely used to transfer the vehicle data.

DTC DESCRIPTION

When the TCM cannot read the data from the ECM through the CAN-BUS line, the TCM sets this code. CAN-BUS circuit malfunctioning or ECM can be a possible cause of this DTC.

DTC DETECTING CONDITION

DTC DETECTING CONDITION CHART

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	Check communication	- Open or short in CAN communication harness - Faulty ECM - Faulty TCM
Enable Conditions	- Input speed (PG-A) > 300rpm - Battery voltage > 10V	
Threshold Value	CAN message transfer error	
Diagnostic Time	1 sec	
Fail Safe	- INTELLIGENT SHIFT is inhibited - Learning for oil pressure control is inhibited - Torque Retard requirement is inhibited - Direct connection control of TCC is inhibited	

DTC U0100 CAN-TIME OUT ECU**COMPONENT LOCATION**

Refer to **DTC U0001**.

GENERAL DESCRIPTION

Refer to **DTC U0001**.

DTC DESCRIPTION

Refer to **DTC U0001**.

DTC DETECTING CONDITION**DTC DETECTING CONDITION CHART**

Item	Detecting Condition & Fail Safe	Possible cause
DTC Strategy	• Check communication	• Open or short in CAN communication harness • Faulty ECM • Faulty TCM
Enable Conditions	• Input speed (PG-A) > 300rpm • Battery voltage > 10V • Timer of ECM CAN monitoring > 500msec	
Threshold Value	• No message from ems.	
Diagnostic Time	• 1.5 sec	
Fail Safe	• INTELLIGENT SHIFT is inhibited • Learning for oil pressure control is inhibited • Torque Retard requirement is inhibited • Direct connection control of TCC is inhibited	

MONITOR SCANTOOL DATA

1. Connect scantool to data link connector (DLC).
2. Engine "ON".
3. Monitor the "CAN COMMUNICATION SERVICE DATA (ENGINE RPM, VEHICLE SPEED SENSOR, THROTTLE P. SENSOR)" parameters on the scantool.
4. Does "CAN BUS LINE DATA" follow the reference data?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or TCM's connector or was repaired and TCM memory was not cleared. Go to **VERIFICATION OF VEHICLE REPAIR** procedure .

NO : --> Go to "**TERMINAL & CONNECTOR INSPECTION**" procedure.

TERMINAL & CONNECTOR INSPECTION

1. Many malfunctions in the electrical system are caused by poor harness and terminals. Faults can also be caused by interference from other electrical systems, and mechanical or chemical damage.
2. Thoroughly check connectors for looseness, poor connection, bending, corrosion, contamination, deterioration, or damage.
3. Has a problem been found?

YES : --> Fault is intermittent caused by poor contact in the sensor's and/or TCM's connector or was repaired and TCM memory was not cleared. And go to **VERIFICATION OF VEHICLE REPAIR** procedure .

NO : --> Go to "**SIGNAL CIRCUIT INSPECTION**" procedure.

VERIFICATION OF VEHICLE REPAIR

After a repair, it is essential to verify that the fault has been corrected.

1. Connect scan tool and select "Diagnostic Trouble Codes (DTCs)" mode.
2. Using a scantool, clear DTC.
3. Operate the vehicle within DTC enable conditions in general information.
4. Are any DTCs present?

YES : --> Go to the applicable troubleshooting procedure.

NO : --> System performing to specification at this time.

AUTOMATIC TRANSAXLE

COMPONENT

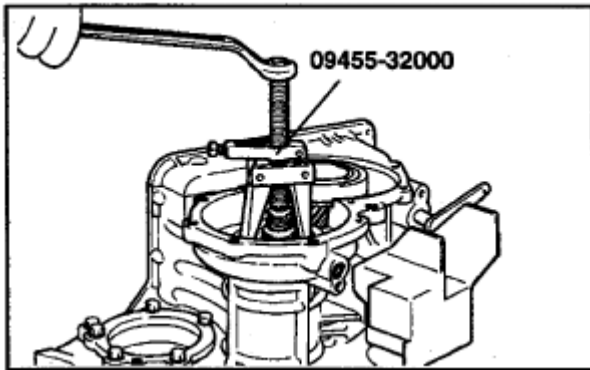


Fig. 134: Identifying Automatic Transaxle Components With Torque Specifications (1 Of 5)
Courtesy of KIA MOTORS AMERICA, INC.

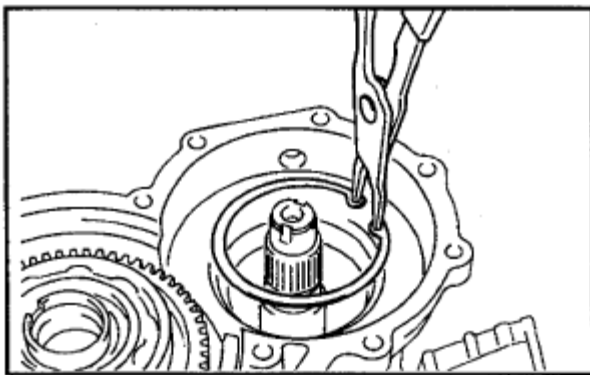


Fig. 135: Identifying Automatic Transaxle Components With Torque Specifications (2 Of 5)
Courtesy of KIA MOTORS AMERICA, INC.

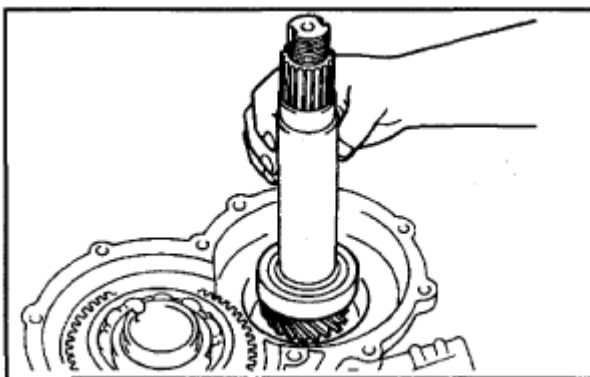


Fig. 136: Identifying Automatic Transaxle Components With Torque Specifications (3 Of 5)
Courtesy of KIA MOTORS AMERICA, INC.

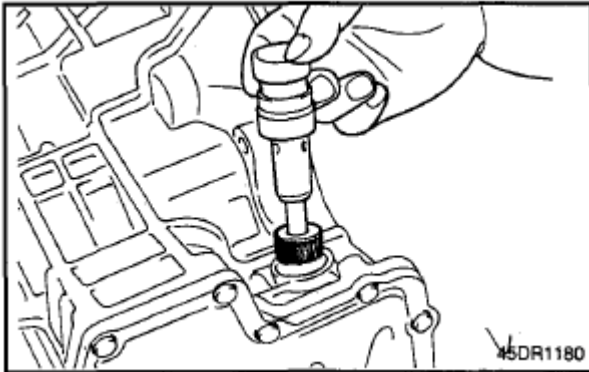


Fig. 137: Identifying Automatic Transaxle Components With Torque Specifications (4 Of 5)
Courtesy of KIA MOTORS AMERICA, INC.

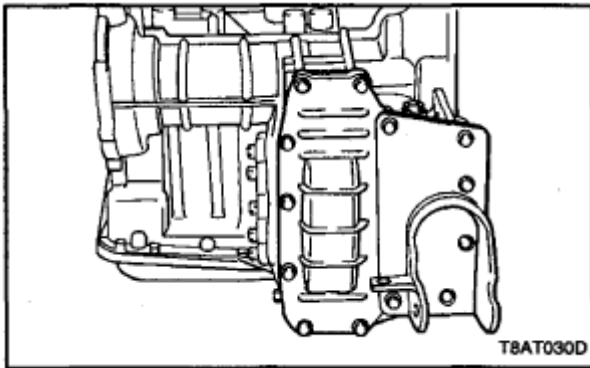


Fig. 138: Identifying Automatic Transaxle Components With Torque Specifications (5 Of 5)
Courtesy of KIA MOTORS AMERICA, INC.

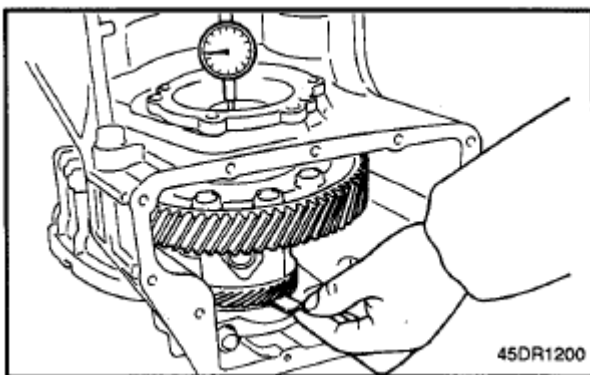


Fig. 139: Automatic Transaxle Components Reference Chart
Courtesy of KIA MOTORS AMERICA, INC.

REMOVAL

CAUTION: • Use fender covers to avoid damaging painted surfaces.

- To avoid damage, unplug the wiring connectors carefully while holding the connector portion.

NOTE:

- Mark all wiring and hoses to avoid misconnection.

1. Disconnect the battery terminals and then remove battery.
2. Remove the battery and battery tray (A).

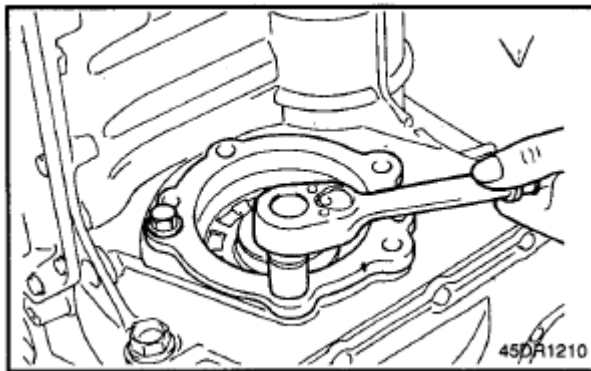


Fig. 140: Identifying Battery And Battery Tray
Courtesy of KIA MOTORS AMERICA, INC.

3. Remove the intake air hose and air cleaner assembly.
 1. Disconnect the AFS (Air Flow Sensor) connector (A).
 2. Disconnect the breather hose (B) from intake air hose (D).
 3. Remove the intake air hose (D) and air cleaner upper cover (C).

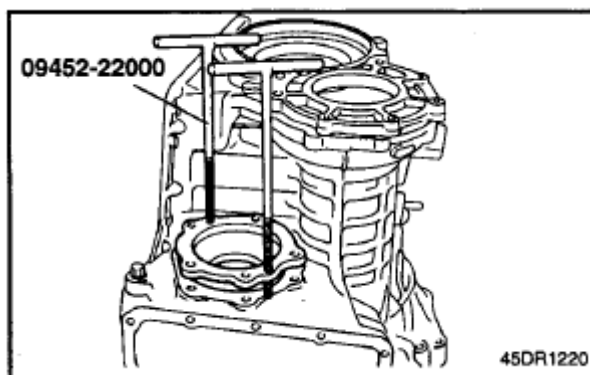


Fig. 141: Identifying Intake Air Hose And Air Cleaner Upper Cover
Courtesy of KIA MOTORS AMERICA, INC.

4. Disconnect the ECM connector (A, B).
5. Remove the air cleaner element and lower cover (C).

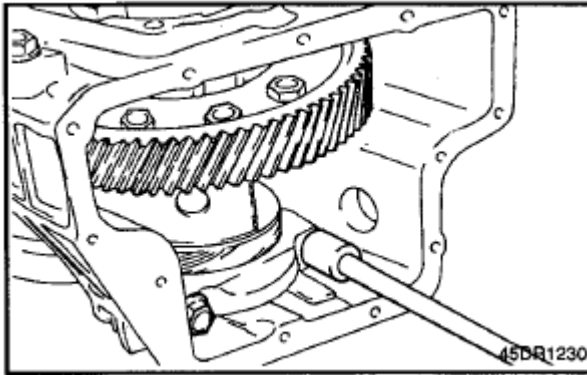


Fig. 142: Identifying Air Cleaner Element And Lower Cover
 Courtesy of KIA MOTORS AMERICA, INC.

4. Remove the ATF (Automatic transaxle fluid) cooler hose (A).

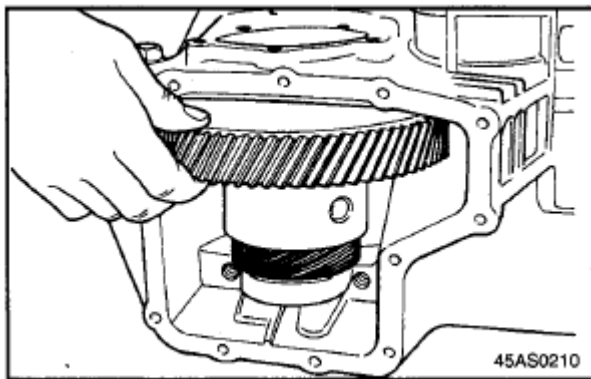


Fig. 143: Identifying ATF (Automatic Transaxle Fluid) Cooler Hose
 Courtesy of KIA MOTORS AMERICA, INC.

5. Remove the transaxle ground cable (A).

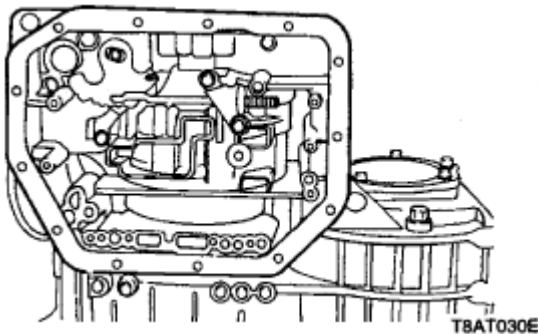


Fig. 144: Identifying Transaxle Ground Cable
 Courtesy of KIA MOTORS AMERICA, INC.

6. Remove the transaxle wire harness connectors and control cable from transaxle.

1. Disconnect the transaxle range switch connector (A).

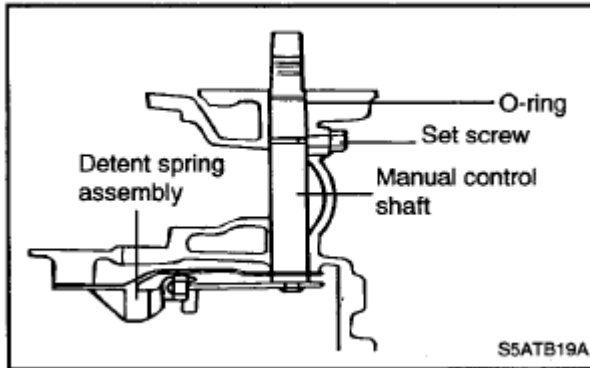


Fig. 145: Identifying Transaxle Range Switch Connector
 Courtesy of KIA MOTORS AMERICA, INC.

2. Disconnect the solenoid valve connector (B).

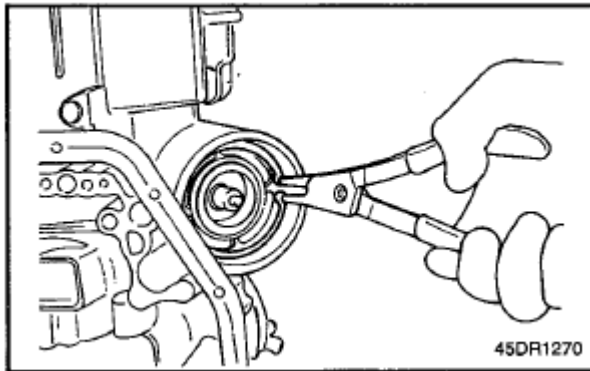


Fig. 146: Identifying Solenoid Valve Connector
 Courtesy of KIA MOTORS AMERICA, INC.

3. Disconnect the fluid temperature sensor connector (C).
4. Disconnect the vehicle speed sensor connector (A).

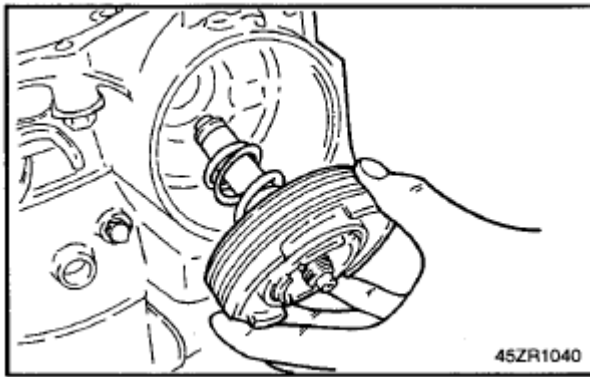


Fig. 147: Identifying Vehicle Speed Sensor Connector
Courtesy of KIA MOTORS AMERICA, INC.

5. Disconnect the band servo switch connector (B).
6. Disconnect the pulse generator A connector (C).
7. Disconnect the pulse generator B connector (D).
8. Remove the control cable nut (A) from transaxle range switch.

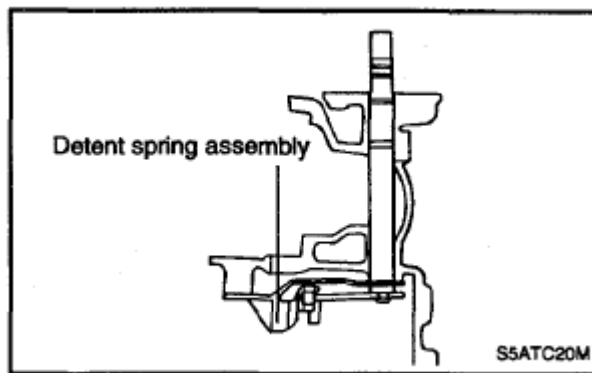
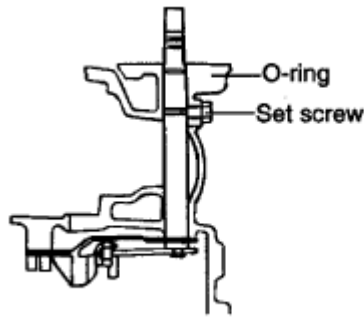


Fig. 148: Identifying Control Cable Nut And Control Cable
Courtesy of KIA MOTORS AMERICA, INC.

9. Remove the control cable (B).
7. Remove the power steering oil hose (A) and drain the power steering oil.



S5ATC20N

Fig. 149: Identifying Power Steering Oil Hose
Courtesy of KIA MOTORS AMERICA, INC.

8. Remove the power steering return hose (A).

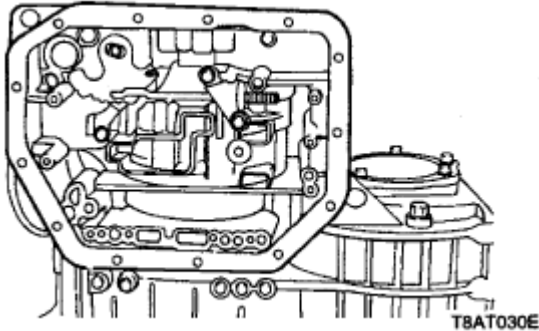


Fig. 150: Identifying Power Steering Return Hose
Courtesy of KIA MOTORS AMERICA, INC.

9. Install the special tools (09200-38001), the engine support fixture and the adapter, on the engine assembly.

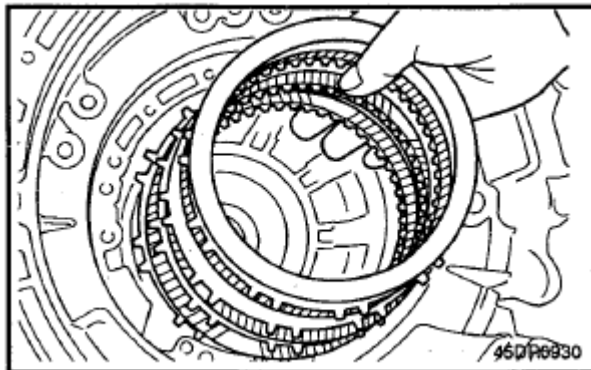


Fig. 151: Identifying SST (09200-38001)
Courtesy of KIA MOTORS AMERICA, INC.

10. Remove the transaxle mounting support bracket (A).

TORQUE:

70~95Nm (700~950kgf.cm, 50~69lb-ft)

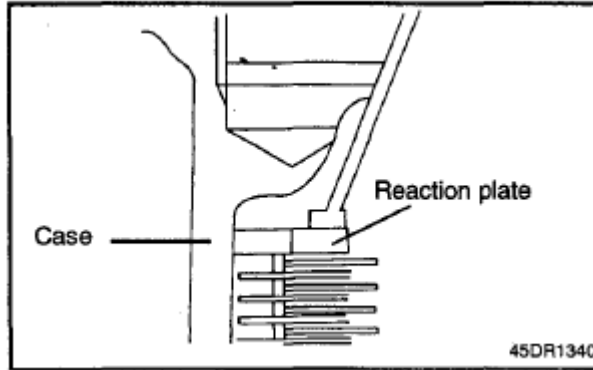


Fig. 152: Identifying Transaxle Mounting Support Bracket
Courtesy of KIA MOTORS AMERICA, INC.

11. Remove the front roll stopper mounting bolt (A).

TORQUE:

50~65Nm (500~650kgf.cm, 36~47lb-ft)

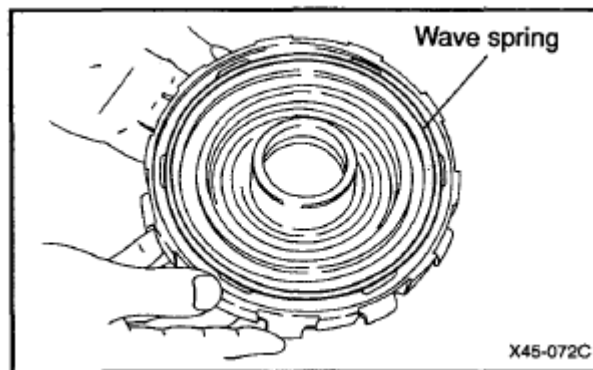


Fig. 153: Identifying Front Roll Stopper Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

12. Remove the rear roll stopper mounting bolt (A).

TORQUE:

50~65Nm (500~650kgf.cm, 36~47lb-ft)

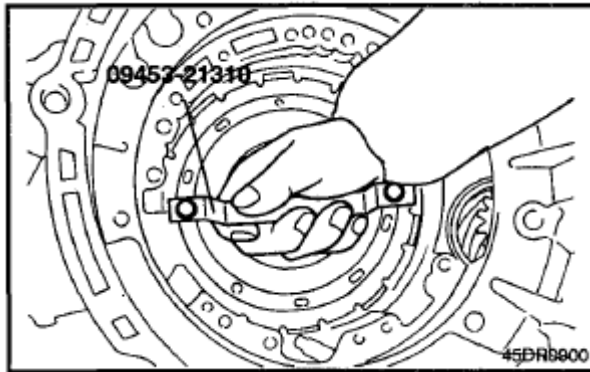


Fig. 154: Identifying Rear Roll Stopper Mounting Bolt
 Courtesy of KIA MOTORS AMERICA, INC.

13. Remove the under cover (A).

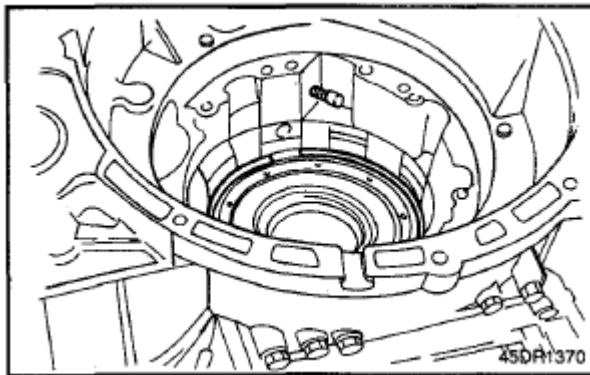


Fig. 155: Identifying Under Cover
 Courtesy of KIA MOTORS AMERICA, INC.

14. Remove the side cover.
15. Remove the front wheel.
16. Remove the drain plug (A) and drain the automatic transaxle fluid.

TORQUE:

35~45Nm (350~450kgf.cm, 25~32lb-ft)

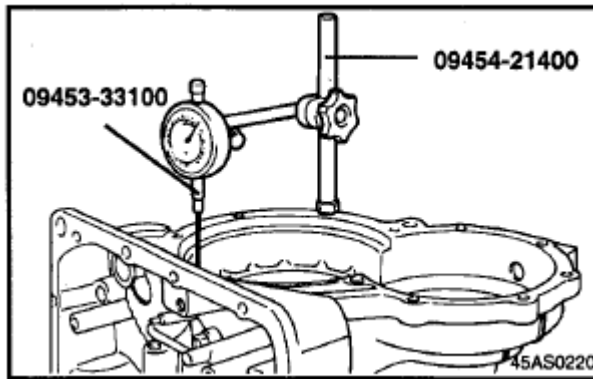


Fig. 156: Identifying Drain Plug
Courtesy of KIA MOTORS AMERICA, INC.

17. Separate the tie rod end (A) from the pin (B) and nut (C).

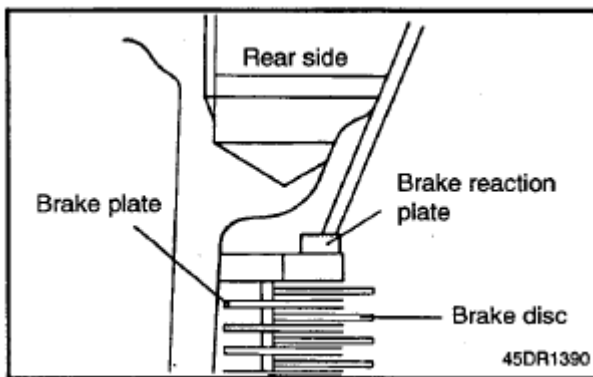


Fig. 157: Separating Tie Rod End From Pin And Nut
Courtesy of KIA MOTORS AMERICA, INC.

18. Remove the ABS wheel speed sensor (A).

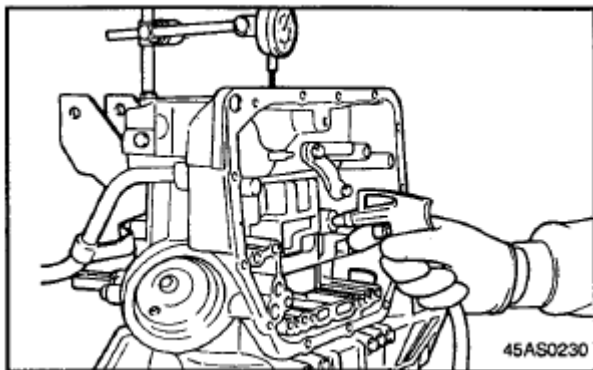


Fig. 158: Identifying ABS Wheel Speed Sensor
Courtesy of KIA MOTORS AMERICA, INC.

19. Remove the front caliper (A) and use a wire to secure the caliper to the vehicle so that it is out of the way.

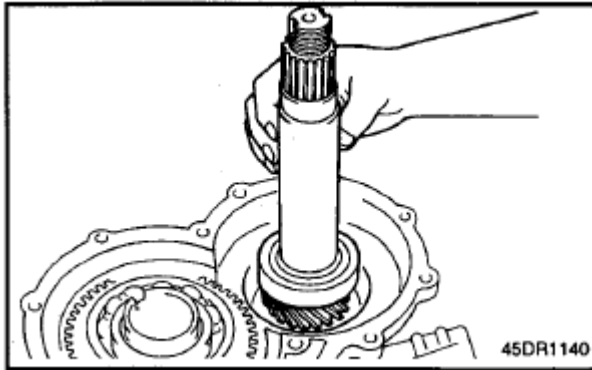


Fig. 159: Identifying Front Caliper
Courtesy of KIA MOTORS AMERICA, INC.

20. Remove the knuckle mounting bolts (A).

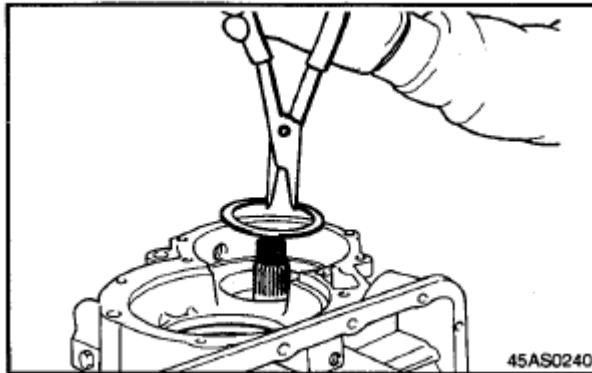


Fig. 160: Identifying Knuckle Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

21. Remove the drive shaft (A) from the transaxle.

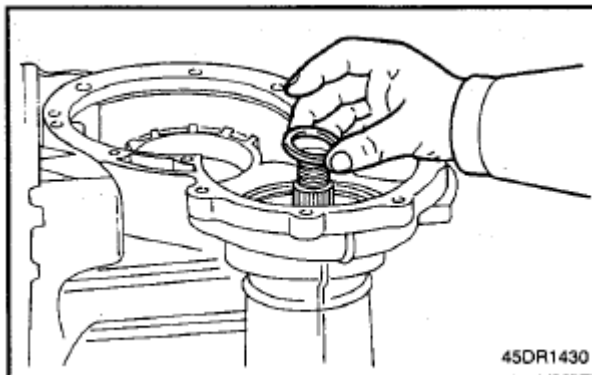
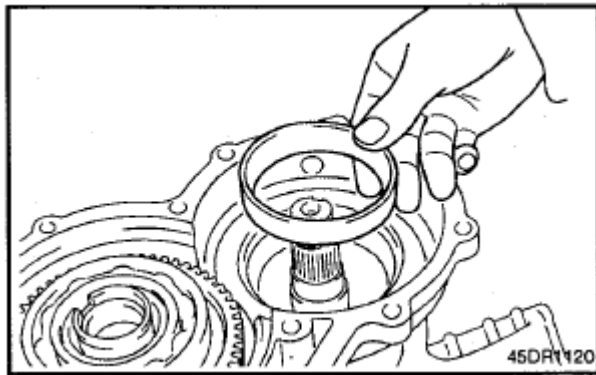


Fig. 161: Identifying Drive Shaft

Courtesy of KIA MOTORS AMERICA, INC.

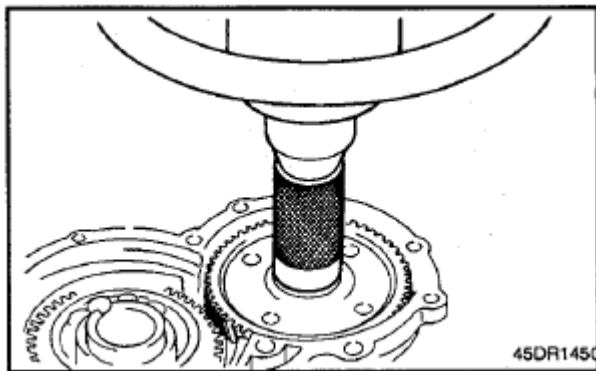
22. Remove the steering U-joint mounting bolt (A).

**Fig. 162: Identifying Steering U-Joint Mounting Bolt**

Courtesy of KIA MOTORS AMERICA, INC.

23. Install the jack (A) for supporting transaxle.

NOTE: When supporting the transaxle assembly, make sure that the weight is applied to a wide area of the jack surface.

**Fig. 163: Supporting Transaxle Assembly**

Courtesy of KIA MOTORS AMERICA, INC.

24. Remove the sub-frame bolt (A) and nut (B).

TORQUE:

Bolts (A): 40~50Nm (400~550Kgf.cm, 29~40lb-ft)

Nuts (B): 160~180Nm (1600~1800Kgf.cm, 110~126lb-ft)

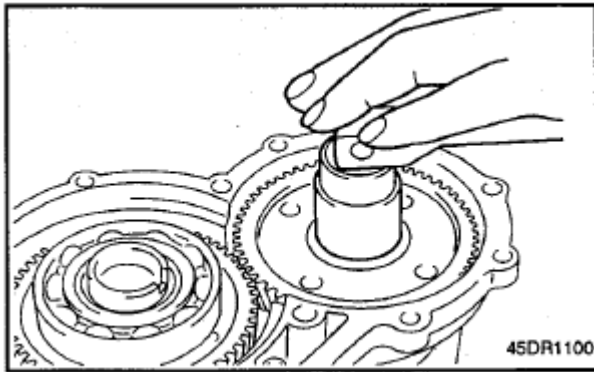


Fig. 164: Identifying Sub Frame Bolts
Courtesy of KIA MOTORS AMERICA, INC.

25. Remove the start motor mounting bolt (A).

TORQUE:

27~34Nm (270~340kgf.cm, 19~24lb-ft)

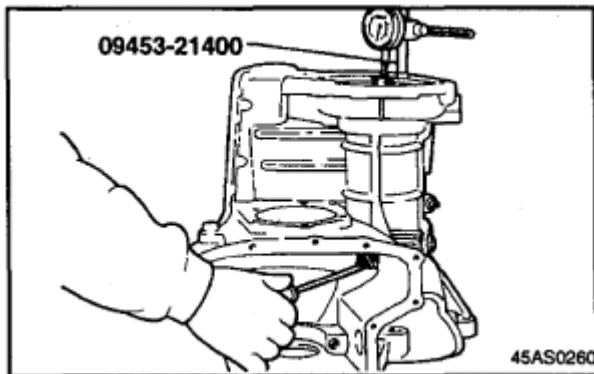


Fig. 165: Identifying Start Motor Mounting Bolt
Courtesy of KIA MOTORS AMERICA, INC.

26. Remove the engine to the torque converter mounting bolts (A). (4EA).

TORQUE:

46~53Nm (460~530kgf.cm, 33~38lb-ft)

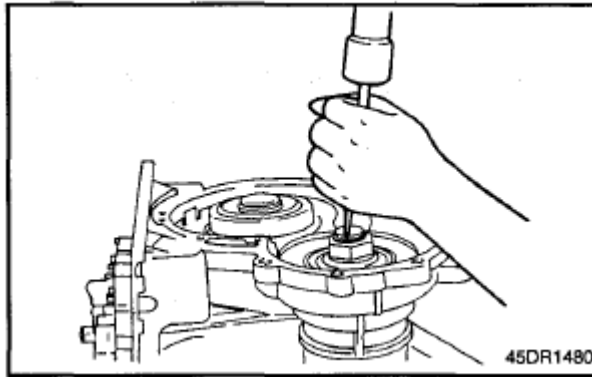


Fig. 166: Identifying Torque Converter Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

27. Remove the engine to automatic transaxle mounting bolts (A).

TORQUE:

Bolts (12mm): 60~80Nm (600~800Kgf.cm, 43~58lb-ft)

Bolts (10mm): 43~55Nm (430~550Kgf.cm, 32~41 lb-ft)

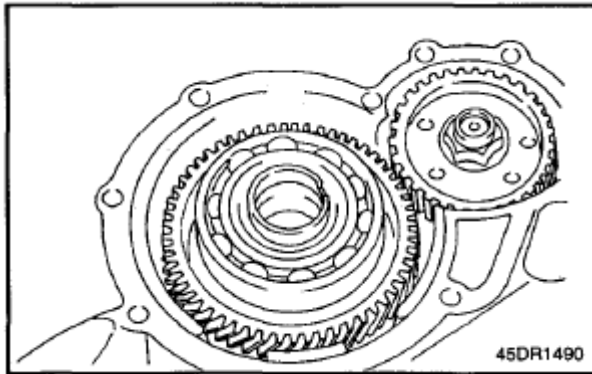


Fig. 167: Identifying Automatic Transaxle Mounting Bolts
Courtesy of KIA MOTORS AMERICA, INC.

28. Remove the transaxle assembly.

CAUTION: Be careful not damage the other parts during removal.

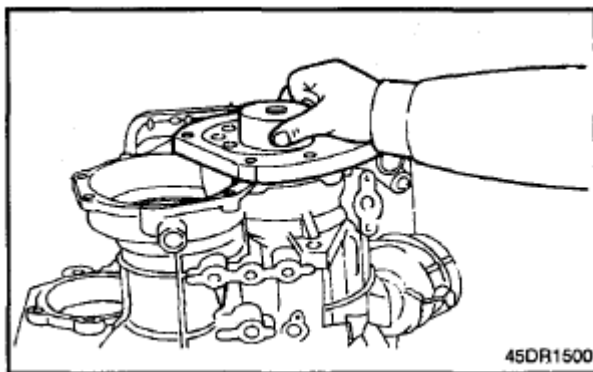


Fig. 168: Identifying Transaxle Assembly
Courtesy of KIA MOTORS AMERICA, INC.

INSTALLATION

1. Attach the torque converter on the transaxle side and mount the transaxle assembly onto the engine.

CAUTION: If the torque converter is mounted first on the engine, the oil seal on the transaxle may be damaged.
Therefore, be sure to first assemble the torque converter to the transaxle.

2. Install the transaxle control cable and adjust as follows.
 1. Move the shift lever and the transaxle range switch to the "N" position, and install the control cable.
 2. When connecting the control cable to the transaxle mounting bracket, install the clip until it contacts the control cable.
 3. Remove any free-play in the control cable by adjusting nut and then check to see that the selector lever moves smoothly.
 4. Check to see that the control cable has been adjusted correctly.

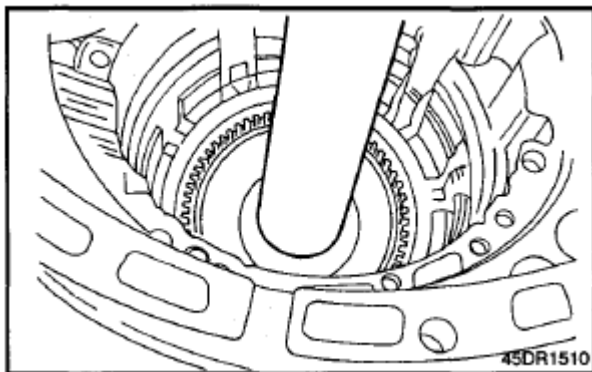


Fig. 169: Identifying Control Cable Connector
Courtesy of KIA MOTORS AMERICA, INC.

3. Installation is the reverse of removal.