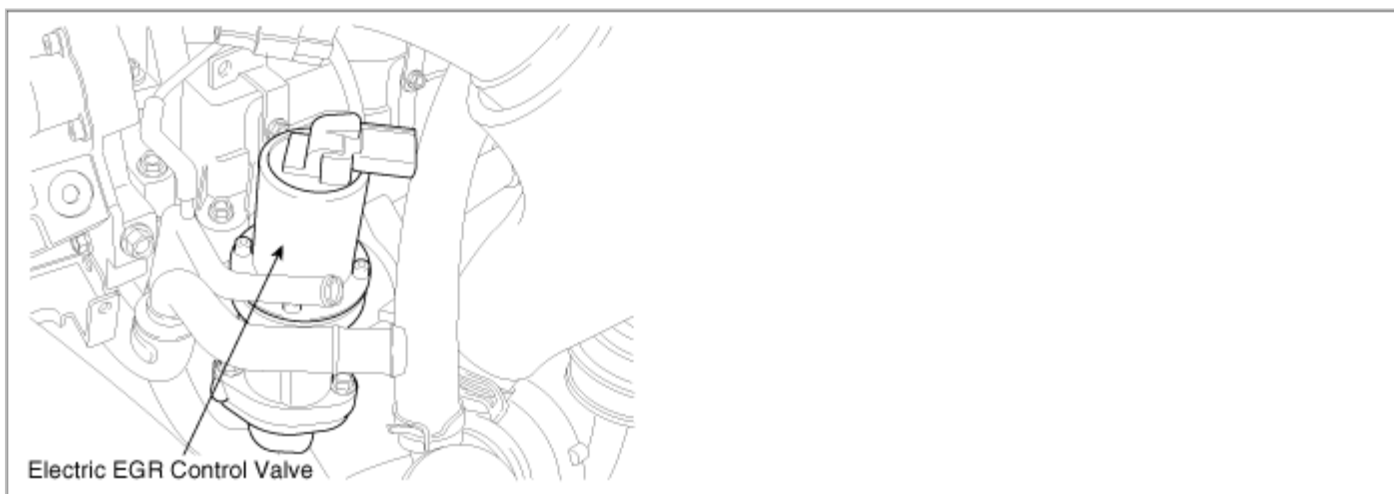


## COMPONENT LOCATION



## GENERAL DESCRIPTION

Receiving ECM signal, linear solenoid type electronic EGR actuator operates EEGR valve directly. ECM performs EGR system feed back control with the information of measured mass air flow (The role of MAFS in diesel engine is different from gasoline engine. Fuel injection quantity is decided by MAFS signal in gasoline engine.) When EGR gas (contains no oxygen) flowing into combustion chamber increases, the air passing through MAFS (contains oxygen) decreases. Thus, with the output signal change of MAFS accompanied by EEGR actuator actuation, ECM determine the amount of recirculated EGR gas quantity.

NOx is produced from the reaction of nitrogen and oxygen. Controlling EGR gas (contains no oxygen) which is recirculated to combustion chamber, if least intake air required for complete combustion flows into combustion chamber, NOx decreases because there is no supplementary oxygen to react with nitrogen.

## DTC DESCRIPTION

P401 is set when ECM/PCM detects that duty amount of EEGR actuator control valve, ENG speed or amount of EGR is exceeded to minimum set point last to more than 15sec. In this case, check that stuck of EEGR actuator, air leakage of intake line.

## DTC DETECTING CONDITION

Item	Detecting Condition			Possible Cause
DTC Strategy	• Signal monitoring(negative governor deviation below limit)			<ul style="list-style-type: none"><li>• EGR actuator stuck</li><li>• EGR actuator component</li><li>• Air leakage of intake line</li></ul>
Enable Conditions	• Engine running			
Threshold Value	• EGR is exceeded to minimum set point			
Diagnostic Time	• 15 sec.			
Fail Safe	Fuel cut	NO		
	EGR Off	YES		
	Fuel	NO		

Fail Safe	Limit	NO	
	Check Lamp	NO	

## SIGNAL WAVEFORM AND DATA

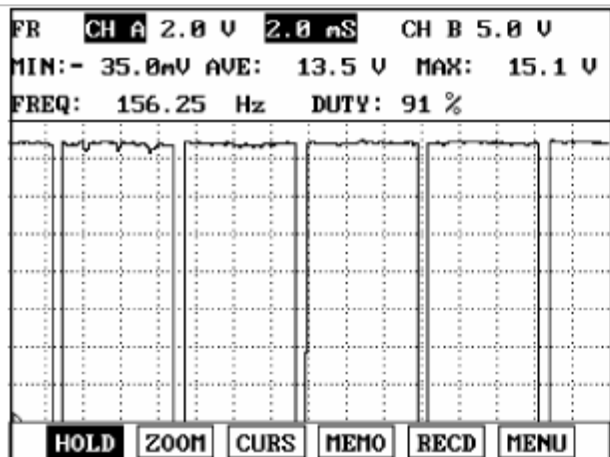


Fig.1

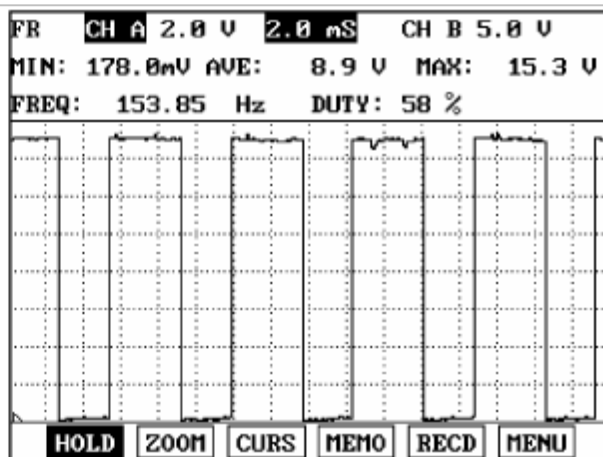


Fig.2

Fig.1) Approx. 10% duty( (-)duty ) signal waveform of EEGR actuator (with EEGR valve closed)

Fig.2) Approx. 40% duty( (-)duty ) signal waveform of EEGR actuator(with EEGR valve opened)

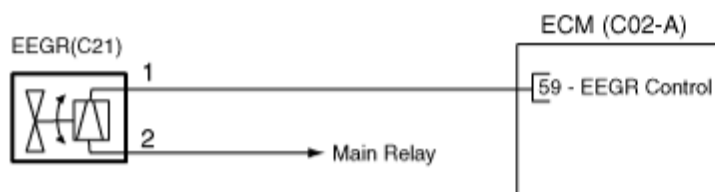
The output of approx. 10% duty is mainly for the diagnosis of EEGR actuator circuit than actuating EEGR.

## SPECIFICATION

EGR actuator component resistance	EGR actuator operating Hz	EGR actuator operating duty
7.3~ 8.3Ω [20°C(68°F)]	142Hz	approx.10%(closed)~40% (opened)

## SCHEMATIC DIAGRAM

### [CIRCUIT DIAGRAM]



### [CONNECTION INFORMATION]

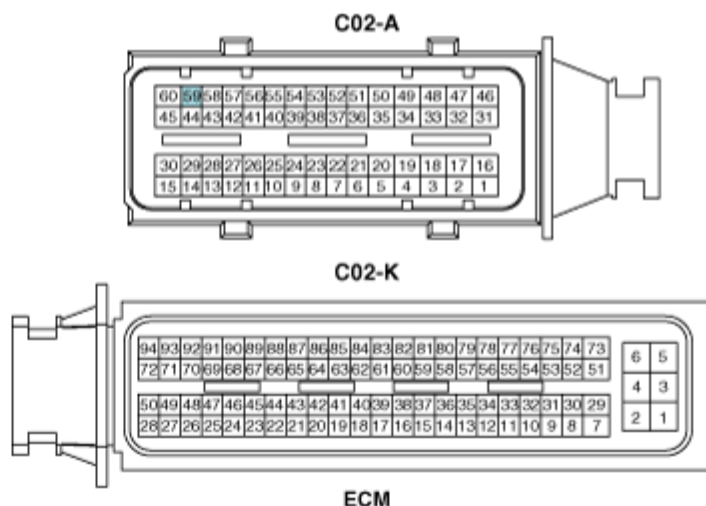
Terminal	Connected to	Function
1	ECM C02-A (59)	EEGR Control
2	Main Relay	Power Supply (B+)

### [HARNESS CONNECTORS]



C21

EEGR



ECM

## MONITOR SCANTOOL DATA

1. Connect Scantool to Data Link Connector (DLC).
2. Warm engine up to normal operating temperature.
3. Turn "OFF" electrical devices and A/C.
4. Monitor "AIR MASS PER CYLINDER" parameter on the Scantool.

Specification : When EEGR actuator does not operate 12.4% duty) at idle : 700mg/st  $\pm$  50 mg/st

When EEGR actuator operates(Approx. 45% duty) at idle : 360mg/st  $\pm$  50 mg/st

1.2 CURRENT DATA			11/68
✖	FUEL PRESSURE MEASURED	27.5 MPa	▲
✖	FUEL PRESS.S/POINT	27.5 MPa	■
✖	AIR MASS PER CYLINDER	706.6mg/hu	
✖	AIR TEMPERATURE SENSOR	22.9 °C	
✖	AIR TEMPE. VOLTAGE	3176 mV	
✖	EGR ACTUATOR	12.4 %	
✖	CLUTCH SWITCH	ON	
✖	ENGINE SPEED SENSOR	802 rpm	▼
FIX	PART	FULL	HELP GRPH RCRD

Fig.1

1.2 CURRENT DATA			11/68
✖	FUEL PRESSURE MEASURED	27.5 MPa	▲
✖	FUEL PRESS.S/POINT	27.5 MPa	■
✖	AIR MASS PER CYLINDER	449.6mg/hu	
✖	AIR TEMPERATURE SENSOR	22.9 °C	
✖	AIR TEMPE. VOLTAGE	3176 mV	
✖	EGR ACTUATOR	57.0 %	
✖	CLUTCH SWITCH	ON	
✖	ENGINE SPEED SENSOR	812 rpm	▼
FIX	PART	FULL	HELP GRPH RCRD

Fig.2

Fig.1) Check if "AIR MASS PER CYLINDER" is 700mg/st  $\pm$  50mg/st without EEGR operation at warm idle (EEGR actuator 12.4% duty)

Fig.2) Check if "AIR MASS PER CYLINDER" is 360mg/st  $\pm$  50mg/st with EEGR operation at warm idle

(EEGR actuator approx. 45% duty)

※ EEGR actuator operates as decelerating after rapid acceleration when idle EEGR does not operate, EEGR actuator duty rises to approx. 45% at operating condition. This controlling process lasts for more than 60 sec. then EEGR actuator turns "OFF" (duty 12.4%).

## TERMINAL AND CONNECTOR INSPECTION

1. Electrical systems consist of a lot of harness and connectors, poor connection of terminals can cause various problems and damage of component.
2. Perform checking procedure as follows.
  - (1) Check damage of harness and terminals : Check terminals for contact resistance, corrosion and deformation.
  - (2) Check connecting condition of ECM and component connector : Check terminal separation, damage of locking device and connecting condition between terminal and wiring.

Disconnect the pin which requires checking at male connector and insert it to the terminal at female connector for checking connecting condition. ( after checking, reconnect the pin at correct position. )

3. Is the problem found?

**YES**

▶ Repair the trouble causing part and go to "Verification of Vehicle Repair".

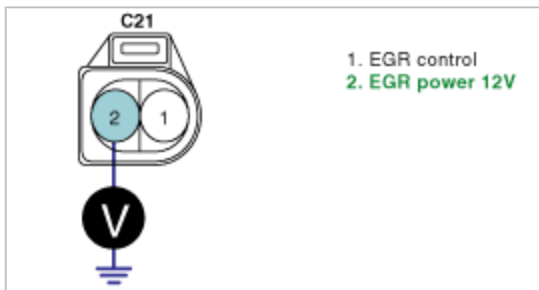
**NO**

▶ Go to "Power Circuit Inspection".

## POWER CIRCUIT INSPECTION

1. Check power circuit voltage
  - (1) IG KEY "OFF", ENGINE "OFF"
  - (2) Disconnect EEGR actuator connector
  - (3) IG KEY "ON"
  - (4) Measure the voltage of terminal 2 of EEGR actuator connector.

Specification : 11.5V~13.0V



- (5) Is the measured voltage within the specification?

**YES**

▶ Go to "Control Circuit Inspection".

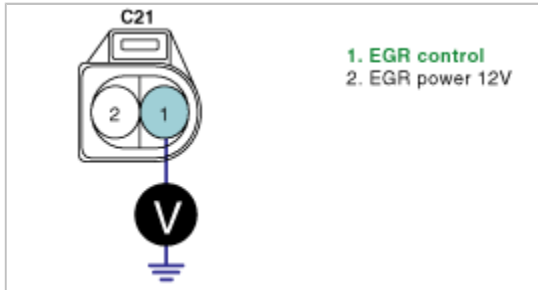
**NO**

▶ Repair E/R JUNCTION BOX 15A ECU SEN FUSE and related circuit and go to "Verification of Vehicle Repair".

## CONTROL CIRCUIT INSPECTION

1. Check control circuit monitoring voltage
  - (1) IG KEY "OFF", ENGINE "OFF"
  - (2) Disconnect EEGR actuator connector.
  - (3) IG KEY "ON"
  - (4) Measure the voltage of terminal 1 of EEGR actuator connector.

Specification : 3.2V~3.7V



- (5) Is the measured voltage within the specification?

**YES**

- ▶ Go to "Component Inspection".

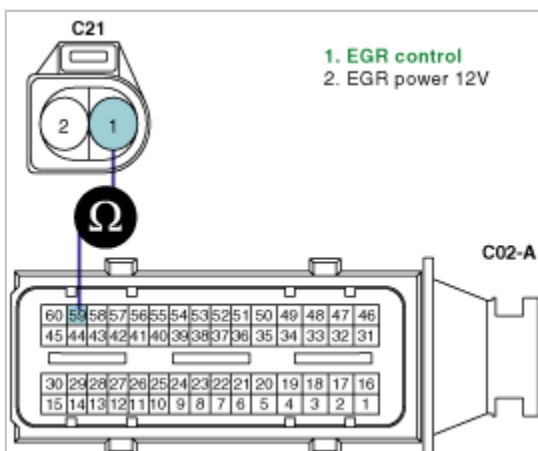
**NO**

- ▶ When voltage is not detected : Go to "2. Check open in control circuit" as follows.
- ▶ When high voltage is detected : Repair short to battery and go to "Verification of Vehicle Repair".

2. Check open in control circuit

- (1) IG KEY "OFF", ENGINE "OFF"
- (2) Disconnect EEGR actuator connector and ECM connector
- (3) Check continuity between EEGR actuator terminal 1 and ECM harness connector (C02-A) terminal 59.

specification : Continuity ( below 1.0Ω )



- (4) Is the measured resistance within the specification?

**YES**

- ▶ Repair short to ground and go to "Verification of Vehicle Repair".

**NO**

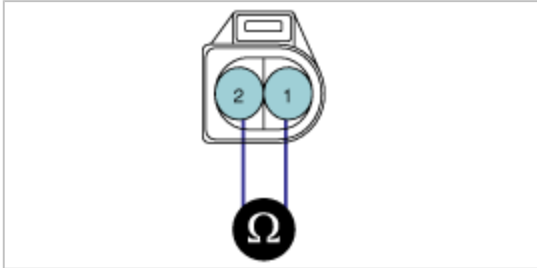
- Repair open in control circuit and go to "Verification of Vehicle Repair".

## COMPONENT INSPECTION

### 1. Check EEGR actuator component resistance

- (1) IG KEY "OFF", ENGINE "OFF".
- (2) Disconnect EEGR actuator connector.
- (3) Measure the resistance between EGR actuator component terminal 1 and 2.

Specification : 7.3~ 8.3Ω [20°C(68°F)]



- (4) Is EEGR actuator component resistance within the specification?

**YES**

- Go to "2. Check EEGR actuator operation condition".

**NO**

- Replace EEGR actuator and go to "Verification of Vehicle Repair".

### 2. Check EEGR actuator operation condition

- (1) IG KEY "OFF", ENGINE "OFF"
- (2) Check that MAFS is installed in correctly according to the direction of arrow on MAFS assy'.
- (3) Check contamination of air cleaner filter.
- (4) IG KEY "ON", ENGINE "ON".
- (5) Let IDLE RPM last after warming engine up.
- (6) Check the leakage of intake system(the leakage or damage of intercooler).
- (7) Check that VGT operates correctly.( Check if vacuum operating state of VGT actuator is appropriate, if VGT diaphragm and unison ring are stuck.)
- (8) Check that EEGR actuator does not operate.  
( EEGR actuator turns "OFF" and 12.4% duty is outputted 1 min. after rapid acceleration. )
- (9) Monitor signal voltage of MAFS when engine speed lasts at approx. 800RPM using Scantool.
- (10) Check MAFS output signal at idle after rapid acceleration.(EEGR actuator duty 45%)

Specification : When EEGR actuator does not operate (12.4%) at idle : 700mg/st ± 50 mg/st

When EEGR actuator operates(45%) at idle : 360mg/st ± 50 mg/st

- (11) Is output signal within the specification?

**YES**

- Go to "Verification of Vehicle Repair".

**NO**

- Check that EEGR actuator is stuck. If it is, replace EEGR actuator assembly then, go to "Verification of Vehicle Repair".



#### VERIFICATION OF VEHICLE REPAIR

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

1. After connecting Scantool select "DIAGNOSTIC TROUBLE CODES(DTCs)" mode.
2. Clear recorded DTC using Scantool.
3. Drive the vehicle within DTC "Enable conditions" in "General information".
4. After selecting "DIAGNOSTIC TROUBLE CODES(DTCs)" mode and check if DTC is recorded again.
5. Are any DTCs recorded ?

**YES**

- ▶ Go to the DTC guide of recorded NO. in Scantool.

**NO**

- ▶ System operates within specification.