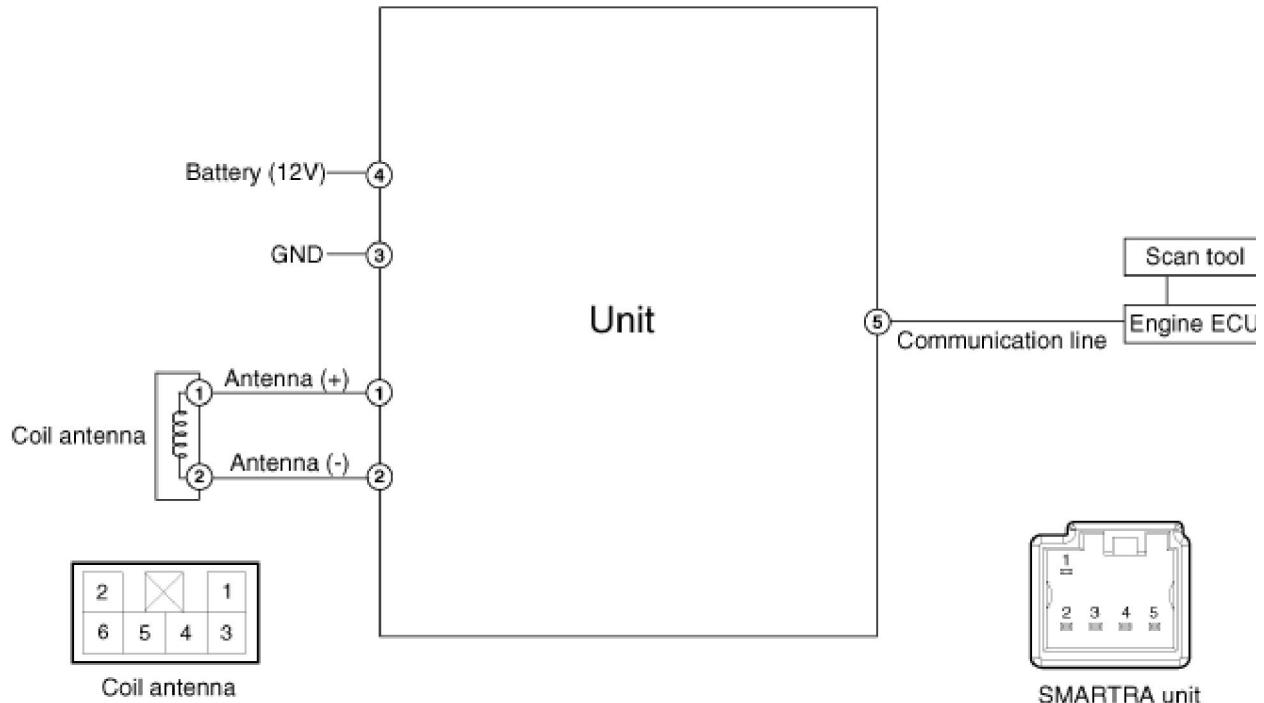


1. Install the height sensor unit.
2. Install the height sensor assembly after connecting the connector.
3. Install the height sensor linkage on the front axle and rear axle.
4. Connect the negative (-) battery terminal.

Body Electrical System > Immobilizer System > Schematic Diagrams

Circuit Diagram



Body Electrical System > Immobilizer System > Description and Operation

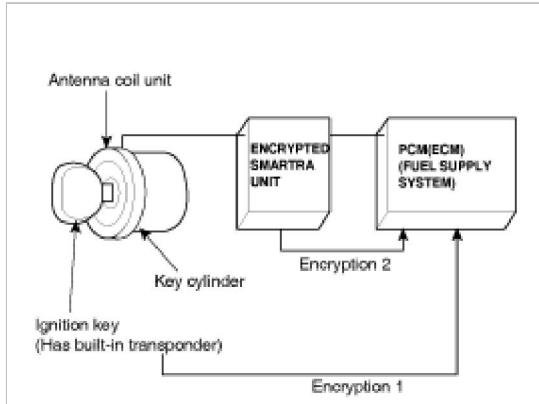
Description

The immobilizer system will disable the vehicle unless the proper ignition key is used, in addition to the currently available anti-theft systems such as car alarms, the immobilizer system aims to drastically reduce the rate of auto theft.

1. Encrypted SMARTRA type immobilizer
 - A. The SMARTRA system consists of a passive challenge - response (mutual authentication) transponder located in the ignition key, an antenna coil, a encoded SMARTRA unit, an indicator light and the PCM (ECM).
 - B. The SMARTRA communicates to the PCM(ECM) (Engine Control Module) via a dedicated communications line. Since the vehicle engine management system is able to control engine mobilization, it is the most suitable unit to control the SMARTRA.
 - C. When the key is inserted in the ignition and turned to the ON position, the antenna coil sends power to the transponder in the ignition key. The transponder then sends a coded signal back through the SMARTRA unit to the PCM(ECM).
 - D. If the proper key has been used, the PCM(ECM) will energize the fuel supply system. The immobilizer indicator light in the cluster will simultaneously come on for more than five seconds, indicating that the

SMARTRA unit has recognized the code sent by the transponder.

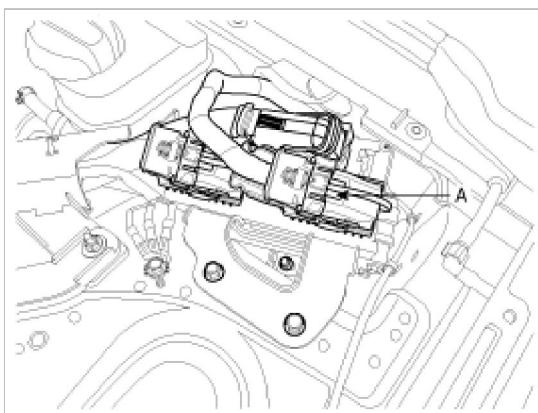
- E. If the wrong key has been used and the code was not received or recognized by the PCM(ECM) the indicator light will continue blinking for about five seconds until the ignition switch is turned OFF.
- F. If it is necessary to rewrite the PCM(ECM) to learn a new key, the dealer needs the customer's vehicle, all its keys and the Hi-scan (pro) equipped with an immobilizer program card. Any key that is not learned during rewriting will no longer start the engine.
- G. The immobilizer system can store up to eight key codes.
- H. If the customer has lost his key, and cannot start the engine, contact Hyundai motor service station.



Components Operations

PCM (Power Train Control Module)

1. The PCM(ECM) (A) carries out a check of the ignition key using a special encryption algorithm, which is programmed into the transponder as well as the PCM(ECM) simultaneously. Only if the results are equal, the engine can be started. The data of all transponders, which are valid for the vehicle, are stored in the PCM (ECM).
- ERN (Encrypted Random Number) value between EMS and encrypted smartra unit is checked and the validity of coded key is decided by EMS.

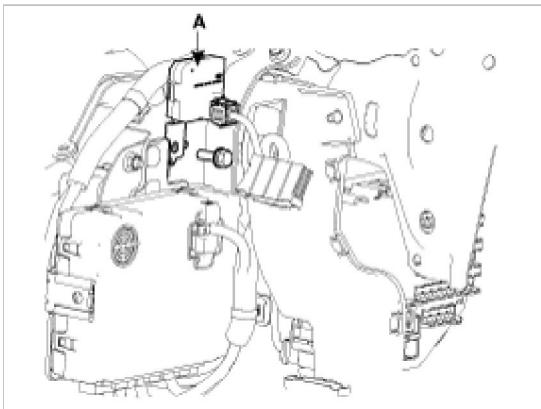


Encrypted SMARTRA Unit (A)

The SMARTRA carries out communication with the built-in transponder in the ignition key. This wireless communication runs on RF (Radio frequency of 125 kHz). The SMARTRA is mounted behind of the crash pad close to center cross bar.

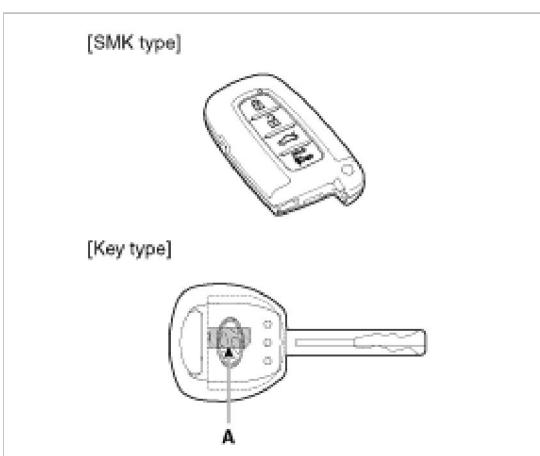
The RF signal from the transponder, received by the antenna coil, is converted into messages for serial communication by the SMARTRA device. And, the received messages from the PCM(ECM) are converted into an RF signal, which is transmitted to the transponder by the antenna.

The SMARTRA does not carry out the validity check of the transponder or the calculation of encryption algorithm. This device is only an advanced interface, which converts the RF data flow of the transponder into serial communication to the PCM(ECM) and vice versa.



Transponder (Built-in Keys)

The transponder (A) has an advanced encryption algorithm. During the key teaching procedure, the transponder will be programmed with vehicle specific data. The vehicle specific data are written into the transponder memory. The write procedure is once only; therefore, the contents of the transponder can never be modified or changed.

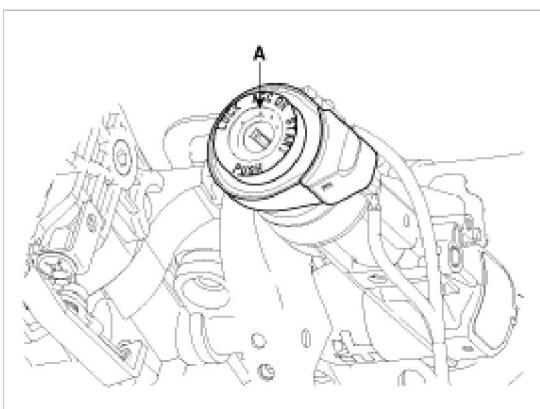


Antenna Coil

The antenna coil (A) has the following functions.

- The antenna coil supplies energy to the transponder.
- The antenna coil receives signal from the transponder.
- The antenna coil sends transponder signal to the SMARTRA.

It is located directly in front of the steering handle lock.



Body Electrical System > Immobilizer System > Repair procedures

Teaching Procedures

1. Key Teaching Procedure

Key teaching must be done after replacing a defective PCM(ECM) or when providing additional keys to the vehicle owner.

The procedure starts with an PCM(ECM) request for vehicle specific data (PIN code: 6digits) from the tester. The "virgin" PCM(ECM) stores the vehicle specific data and the key teaching can be started. The "learnt" PCM(ECM) compares the vehicle specific data from the tester with the stored data. If the data are correct, the teaching can proceed.

If incorrect vehicle specific data have been sent to the PCM(ECM) three times, the PCM(ECM) will reject the request of key teaching for one hour. This time cannot be reduced by disconnecting the battery or any other manipulation. After reconnecting the battery, the timer starts again for one hour.

The key teaching is done by ignition on with the key and additional tester commands. The PCM(ECM) stores the relevant data in the EEPROM and in the transponder. Then the PCM(ECM) runs the authentication required for confirmation of the teaching process. The successful programming is then confirmed by a message to the tester.

If the key is already known to the PCM(ECM) from a previous teaching, the authentication will be accepted and the EEPROM data are updated. There is no changed transponder content (this is impossible for a learnt transponder).

The attempt to repeatedly teach a key, which has been taught already during the same teaching cycle, is recognized by the PCM(ECM). This rejects the key and a message is sent to the tester.

The PCM(ECM) rejects invalid keys, which are presented for teaching. A message is sent to the tester. The key can be invalid due to faults in the transponder or other reasons, which result from unsuccessful programming of data. If the PCM(ECM) detects different authenticators of a transponder and an PCM(ECM), the key is considered to be invalid.

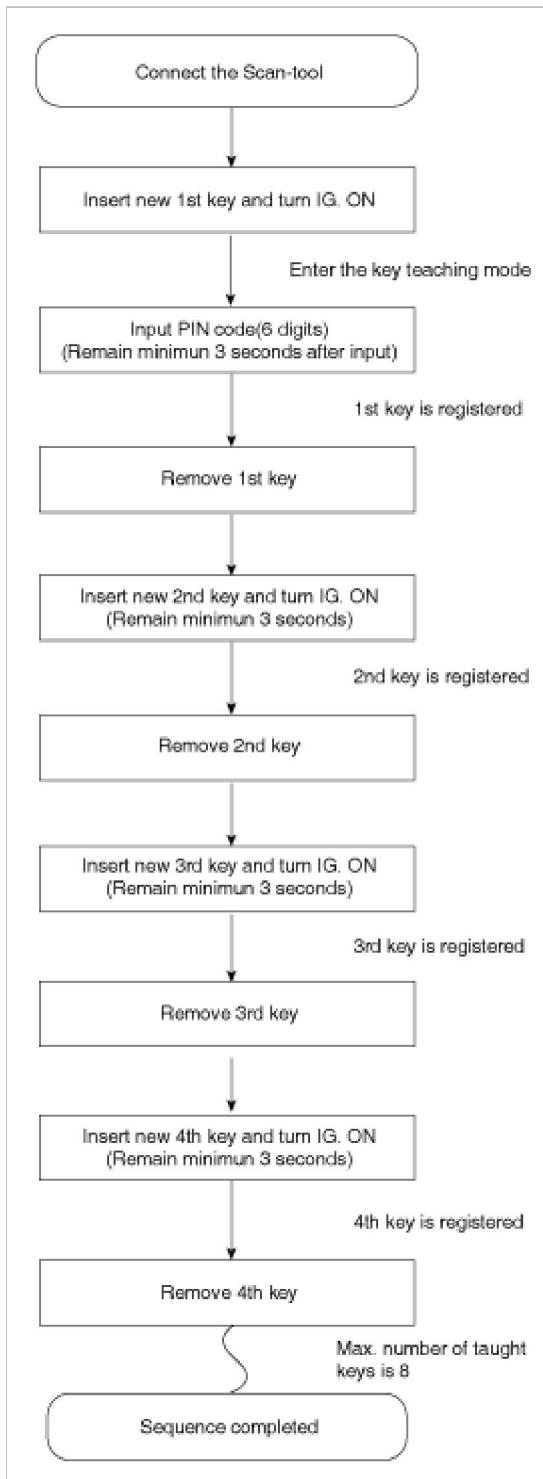
The maximum number of taught keys is 8

If an error occurs during the Immobilizer Service Menu, the PCM(ECM) status remains unchanged and a specific fault code is stored.

If the PCM(ECM) status and the key status do not match for teaching of keys, the tester procedure will be stopped and a specific fault code will be stored at PCM(ECM).

NOTE

Non-SMK system only.



(1) PCM(ECM) learnt status.

1. HYUNDAI VEHICLE DIAGNOSIS ▲
MODEL : GENESIS
88. ELEC. PAKING BRAKE
89. AUTO HEAD LEVELING
10. SMART CRUISE CONTROL
11. BODY CONTROL MODULE
12. MULTI MEDIA SYSTEM
13. IMMOBILIZER
14. SMART KEY CODE SAVING
15. CODE SAVING

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : GENESIS
SYSTEM : IMMOBILIZER
81. CURRENT DATA
82. PASSWORD TEACHING/CHANGING
83. TEACHING
84. NEUTRAL MODE
85. LIMP HOME MODE
86. SMARTA NEUTRAL

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNED
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNED
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNT
1st KEY TEACHING
COMPLETED
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNT
2st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNT
2st KEY TEACHING
COMPLETED
CODE : 234567

(2) PCM(ECM) virgin status.

After replacing new "PCM(ECM)" scantool displays that PCM(ECM) is virgin status in Key Teaching mode. "VIRGIN" status means that PCM(ECM) has not matched any PIN code before.

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
INPUT PIN OF SIX
FIGURE AND PRESS [ENTER] KEY
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
1st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
1st KEY TEACHING
COMPLETED
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
2st KEY TEACHING
ARE YOU SURE ? [Y/N]
CODE : 234567

1.3 TEACHING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
2st KEY TEACHING
COMPLETED
CODE : 234567

2. User Password Teaching Procedure

The user password for limp home is taught at the service station. The owner of the vehicle can select a number with four digits.

The user password teaching is only accepted by a "learnt" PCM(ECM). Before first teaching of user password to an PCM(ECM), the status of the password is "virgin" No limp home function is possible.

The teaching is started by ignition on, with a valid key(learnt key) and sending the user password by tester. After successful teaching, the status of the user password changes from "virgin" to "learnt"

The learnt user password can also be changed. This can be done if the user password status is "learnt" and the tester sends authorization of access, either the old user password or the vehicle specific data. After correct authorization, the PCM(ECM) requests the new user password. The status remains "learnt" and the new user password will be valid for the next limp home mode.

If wrong user passwords or wrong vehicle specific data have been sent to the PCM(ECM) three times continuously or intermittently, the PCM(ECM) will reject the request to change the password for one hour. This time cannot be reduced by disconnecting the battery or any other actions. After reconnecting the battery, the timer starts again for one hour.

(1) User password teaching

<p>1. HYUNDAI VEHICLE DIAGNOSIS</p> <p>MODEL : GENESIS SYSTEM : IMMOBILIZER</p> <p>01. CURRENT DATA 02. PASSWORD TEACHING/CHANGING 03. TEACHING 04. NEUTRAL MODE 05. LIMP HOME MODE 06. SMARTRA NEUTRAL</p>	<p>1.2 PASSWORD TEACHING/CHANGING</p> <p>MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : VIRGIN</p> <p>INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY</p> <p>NEW PASSWORD :</p>	<p>1.2 PASSWORD TEACHING/CHANGING</p> <p>MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : VIRGIN</p> <p>INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY</p> <p>NEW PASSWORD : 2345</p>
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1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
ARE YOU SURE ? [Y/N]
NEW PASSWORD : 2345

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : VIRGIN
COMPLETED
PRESS [ESC] TO EXIT
NEW PASSWORD : 2345

※ In case of putting wrong password, retry from first step after 10 seconds.

(2) User password changing

1. HYUNDAI VEHICLE DIAGNOSIS
MODEL : GENESIS
SYSTEM : IMMOBILIZER
01. CURRENT DATA
02. PASSWORD TEACHING/CHANGING
03. TEACHING
04. NEUTRAL MODE
05. LIMP HOME MODE
06. SMARTRA NEUTRAL

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS
SYSTEM : IMMOBILIZER
STATUS : LEARNED
INPUT OLD PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
OLD PASSWORD :

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : LEARNT
INPUT OLD PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
OLD PASSWORD : 2345

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : LEARNT
INPUT NEW PASSWORD OF FOUR FIGURES AND PRESS [ENTER] KEY
NEW PASSWORD : 1234

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : LEARNT
ARE YOU SURE ? [Y/N]
NEW PASSWORD : 1234

1.2 PASSWORD TEACHING/CHANGING
MODEL : GENESIS SYSTEM : IMMOBILIZER STATUS : LEARNT
COMPLETED PRESS [ESC] TO EXIT
NEW PASSWORD : 1234

Limp Home Function

1. LIMP HOME BY TESTER

If the PCM(ECM) detects the fault of the SMARTRA or transponder, the PCM(ECM) will allow limp home function of the immobilizer. Limp home is only possible if the user password (4 digits) has been given to the PCM(ECM) before. This password can be selected by the vehicle owner and is programmed at the service

station.

The user password can be sent to the PCM(ECM) via the special tester menu.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can only be started during this time. After the time has elapsed, engine start is not possible.

If the wrong user password is sent, the PCM(ECM) will reject the request of limp home for one hour.

Disconnecting the battery or any other action cannot reduce this time. After connecting the battery to the PCM (ECM), the timer starts again for one hour.

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : GENESIS

SYSTEM : IMMOBILIZER

01. CURRENT DATA

02. PASSWORD TEACHING/CHANGING

03. TEACHING

04. NEUTRAL MODE

05. LIMP HOME MODE

06. SMATRA NEUTRAL

1.5 LIMP HOME MODE

MODEL : GENESIS

SYSTEM : IMMOBILIZER

INPUT PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

PASSWORD :

1.5 LIMP HOME MODE

MODEL : GENESIS

SYSTEM : IMMOBILIZER

COMPLETED
PRESS [ESC] TO EXIT

1.5 LIMP HOME MODE

MODEL : GENESIS

SYSTEM : IMMOBILIZER

INPUT PASSWORD OF FOUR
FIGURES AND PRESS [ENTER] KEY

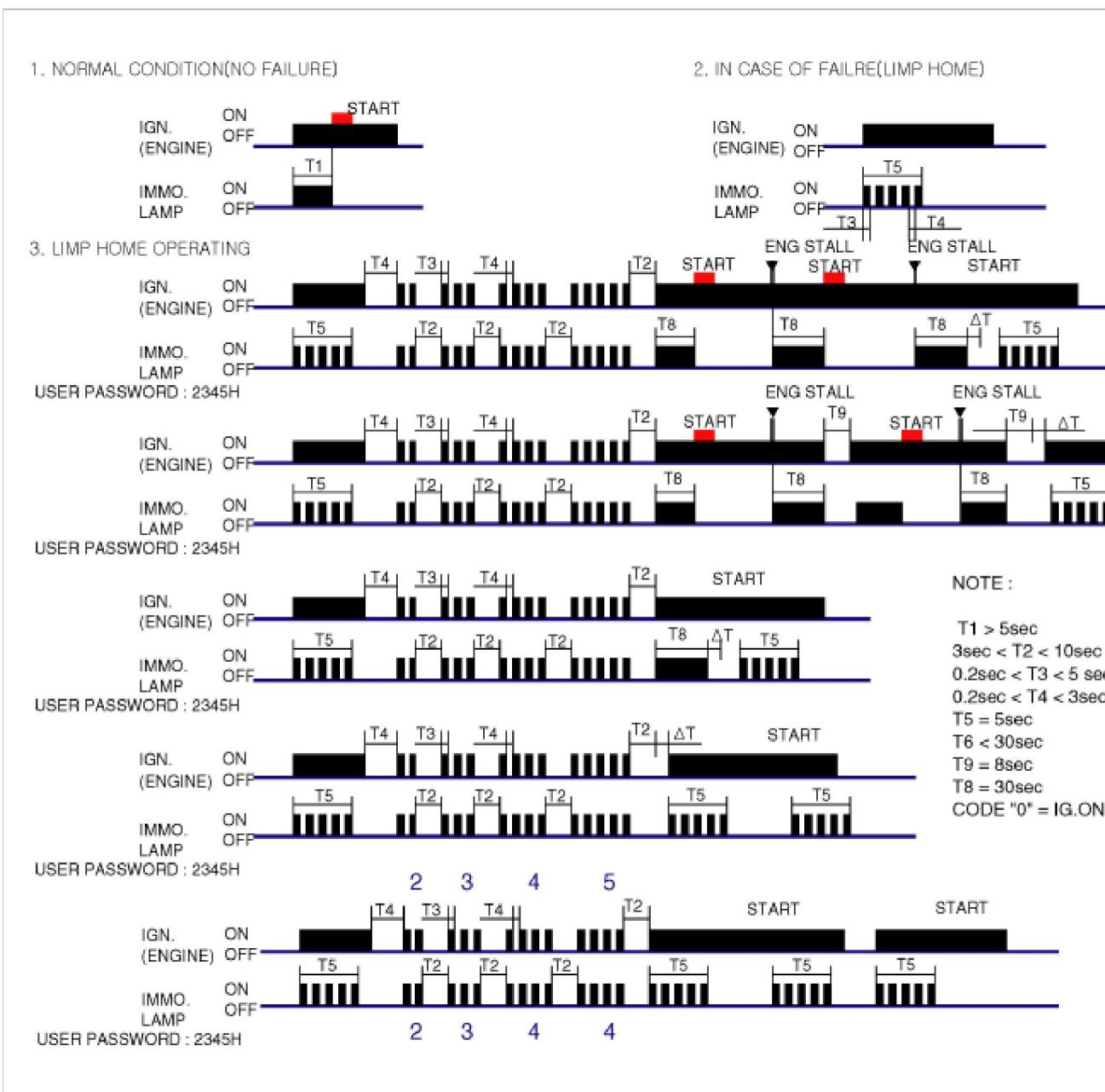
NEW PASSWORD : 2345

2. LIMP HOME BY IGNITION KEY

The limp home can be activated also by the ignition key. The user password can be input to the PCM(ECM) by a special sequence of ignition on/off.

Only if the PCM(ECM) is in status "learnt" and the user password status is "learnt" and the user password is correct, the PCM(ECM) will be unlocked for a period of time (30 sec.). The engine can be started during this time. After the time has elapsed, engine start is not possible. After a new password has been input, the timer (30 sec.) will start again.

After ignition off, the PCM(ECM) is locked if the timer has elapsed 8 seconds. For the next start, the input of the user password is requested again.



Replacement

Problems And Replacement Parts:

Problem	Part set	Scan tool required?
All keys have been lost	Blank key (4)	YES
Antenna coil unit does not work	Antenna coil unit	NO
ECM does not work	PCM(ECM)	YES

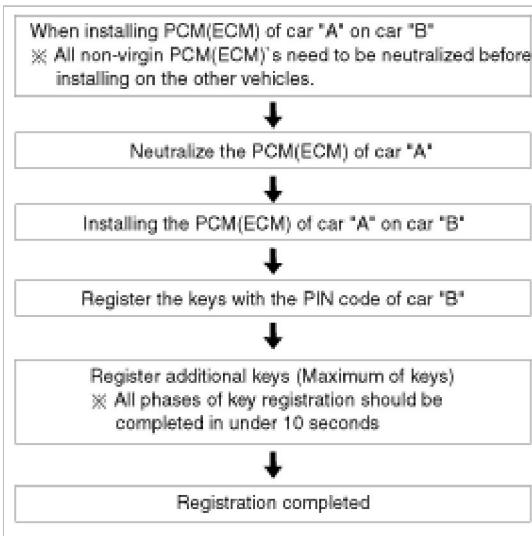
Ignition switch does not work	Ignition switch with Antenna coil unit	YES
Unidentified vehicle specific data occurs	Key, PCM(ECM)	YES
SMARTRA unit does not work	SMARTRA unit	YES

Replacement Of Ecm And Smartra

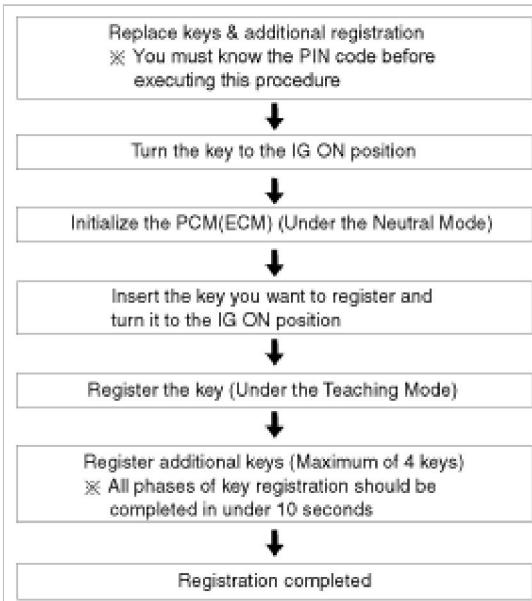
In case of a defective ECM, the unit has to be replaced with a "virgin" or "neutral" ECM. All keys have to be taught to the new ECM. Keys, which are not taught to the ECM, are invalid for the new ECM (Refer to key teaching procedure). The vehicle specific data have to be left unchanged due to the unique programming of transponder.

In case of a defective SMARTRA, it needs teaching the smartra. A new SMARTRA device replaces the old one and smartra need teaching.

1. Things to remember before a replacement (PCM(ECM))



2. Things to remember before a replacement (Keys & Additional registration)



NOTE

1. When there is only one key registered and you wish to register another key, you need to re-register the key which was already registered.
2. When the key #1 is registered and master key #2 is not registered, Put the key #1 in the IG/ON or the start position and remove it. The engine can be started with the unregistered key #2.

(Note that key #2 must be used within 10 seconds of removing key #1)

3. When the key #1 is registered and key #2 is not registered, put the unregistered master key #2 in the IG/ON or the start position.
The engine cannot be started even with the registered key #1.
4. When you inspect the immobilizer system, refer to the above paragraphs 1, 2 and 3.
Always remember the 10 seconds zone.
5. If the pin code & password are entered incorrectly on three consecutive inputs, the system will be locked for one hour.
6. Be cautious not to overlap the transponder areas.
7. Problems can occur at key registration or vehicle starting if the transponders should overlap.

Neutralising Of ECM

The PCM(ECM) can be set to the "neutral" status by a tester.

A valid ignition key is inserted and after ignition on is recorded, the PCM(ECM) requests the vehicle specific data from the tester. The communication messages are described at "Neutral Mode" After successfully receiving the data, the PCM(ECM) is neutralized.

The ECM remains locked. Neither the limp home mode nor the "twice ignition on" function, is accepted by the PCM(ECM).

The teaching of keys follows the procedure described for the virgin PCM(ECM). The vehicle specific data have to be unchanged due to the unique programming of the transponder. If data should be changed, new keys with a virgin transponder are requested.

This function is for neutralizing the PCM(ECM) and Key. Ex) when lost key, Neutralize the PCM(ECM) then teach keys.

(Refer to the Things to do when Key & PIN Code the PCM(ECM) can be set to the "neutral" status by a scanner. If wrong vehicle specific data have been sent to SMATRA three times continuously or intermittently, the SMATRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTE

- Neutralizing setting condition
 - In case of PCM(ECM) status "Learnt" regardless of user password "Virgin or Learnt"
 - Input correct PIN code by scanner.
 - Neutralizing meaning .
 - : PIN code (6) & user password (4) deletion.
 - : Locking of ECM (except key teaching permission)
- Neutralizing meaning:
 - PIN Code(6) & User P/Word(4) deletion
 - Locking of EMS(except Key Learning permission)

Function EMS	Engine Running			Learning	
	Learnt Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	No	No	Yes	No

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : GENESIS

SYSTEM : IMMOBILIZER

01. CURRENT DATA

02. PASSWORD TEACHING/CHANGING

03. TEACHING

04. NEUTRAL MODE

05. LIMP HOME MODE

06. SMARTRA NEUTRAL

1.4 EMS NEUTRAL

MODEL : GENESIS

SYSTEM : IMMOBILIZER

STATUS : LEARNED

INPUT PIN OF SIX

FIGURE AND PRESS [ENTER] KEY

CODE : 234567

1.4 EMS NEUTRAL

MODEL : GENESIS

SYSTEM : IMMOBILIZER

STATUS : NEUTRAL

COMPLETED

PRESS [ESC] TO EXIT

1. HYUNDAI VEHICLE DIAGNOSIS

MODEL : GENESIS

SYSTEM : IMMOBILIZER

01. CURRENT DATA

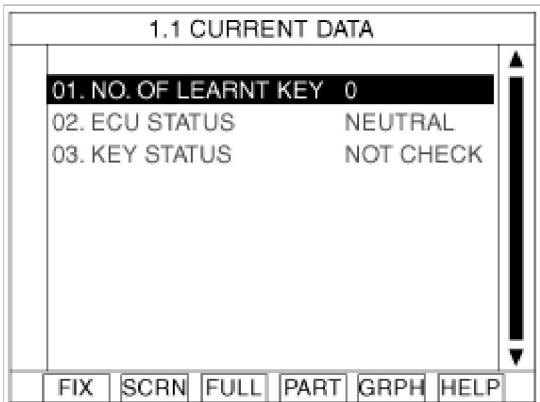
02. PASSWORD TEACHING/CHANGING

03. TEACHING

04. NEUTRAL MODE

05. LIMP HOME MODE

06. SMARTRA NEUTRAL



Neutralising Of SMARTRA

The EMS can be set to the status "neutral" by tester

Ignition key (regardless of key status) is inserted and after IGN ON. If receiving the correct vehicle password from GST, SMARTRA can be neutralized. The neutralization of SMARTRA is possible if DPN is same as the value inputted by GST.

In case that the SMARTRA status is neutral, the EMS keeps the lock state. And the start is not possible by "twice ignition".

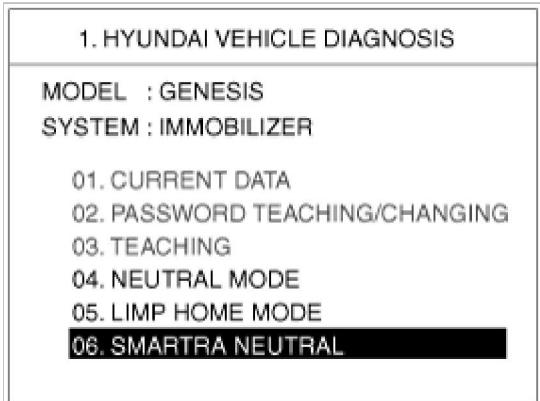
In case of changing the vehicle password, new virgin transponder must be only used. And in case of virgin key, after Learning the key of vehicle password, it can be used.

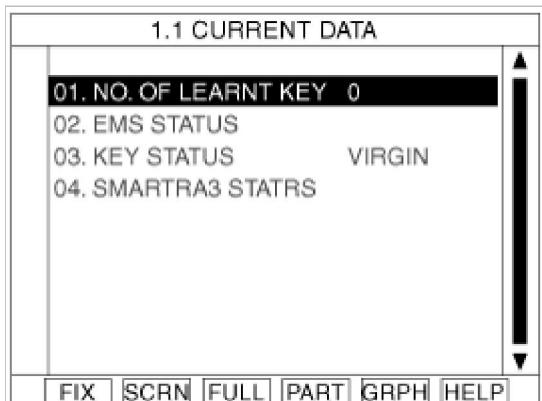
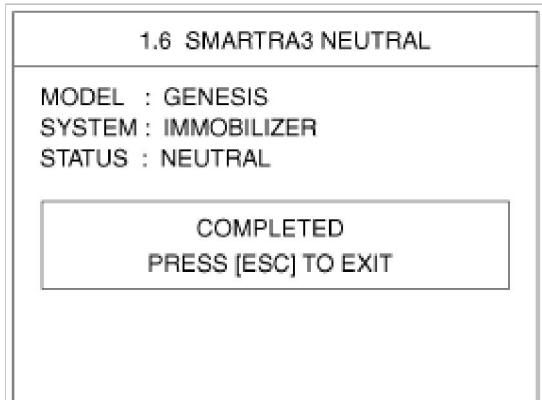
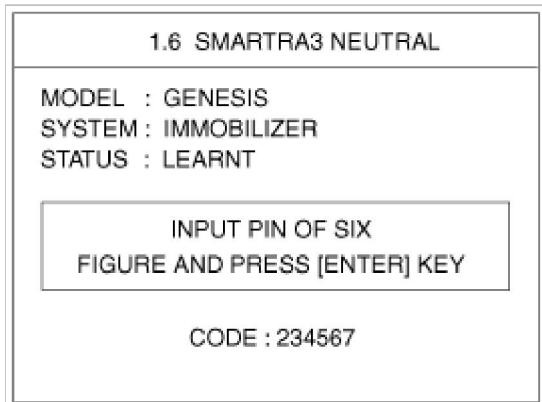
If wrong vehicle specific data have been sent to SMARTRA three times continuously or intermittently, the SMARTRA will reject the request to enter neutral mode for one hour. Disconnecting the battery or other manipulation cannot reduce this time. After connecting the battery the timer starts again for one hour.

NOTE

- Neutralizing Setting condition :
 - In case of "SMARTRA status", "Learned"
 - Input correct Pin code by tester
- Neutralizing meaning :
 - Vehicle password(DPN Code) & SEK Code deletion.
 - Permission of New DPN Learning.

Function SMARTRA	Engine Running		Learning		
	Learned Key	Limp home	Twice Ignition	Key	User Password
Neutral	No	Yes (EMS Learned)	No	Yes	No

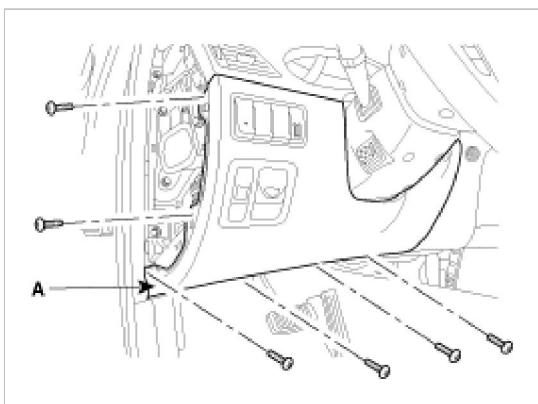




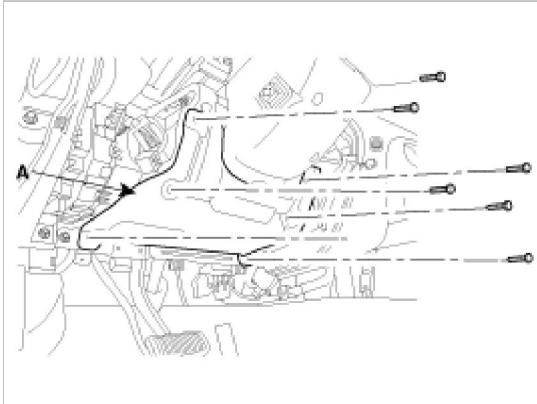
Body Electrical System > Immobilizer System > Immobilizer Control Unit > Repair procedures

Removal

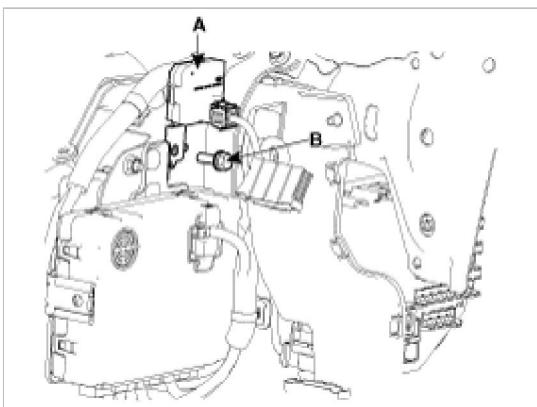
1. Disconnect the negative (-) battery terminal.
2. Remove the crash pad lower panel (A). (Refer to the Body group - "Crash pad").



3. Remove the reinforcing panel (A).



4. Disconnect the 5P connector of the SMARTRA unit and then remove the SMARTRA unit (A) after loosening a nut (B).



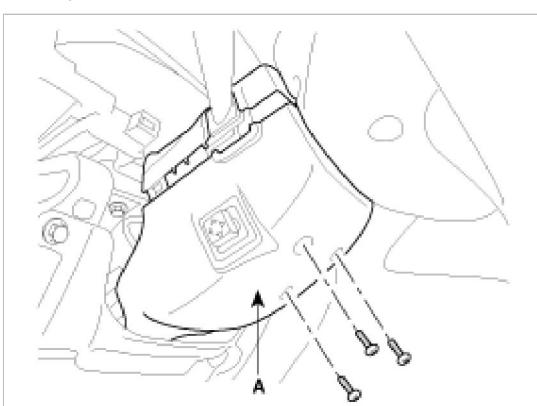
Installation

1. Install the immobilizer control unit after connecting the unit connector.
2. Install the reforing panel.
3. Install the crash pad lower panel.

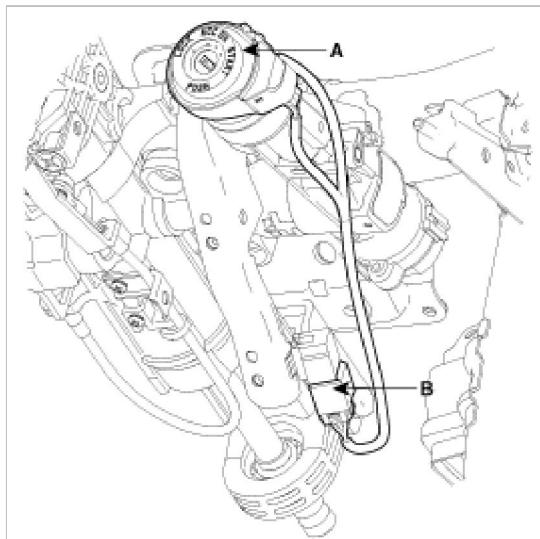
Body Electrical System > Immobilizer System > Antenna Coil > Repair procedures

Removal

1. Disconnect the negative (-) battery terminal.
2. Remove the steering column upper(A) and lower(B) shrouds. (Refer to the ST group - "Steering column and shaft").



3. Disconnect the 6P connector of the coil antenna and then remove the coil antenna (A) after loosening the screw.



Installation

1. Install the coil antenna and connect the 6P connector.
2. Install the steering column upper and lower shrouds.

Body Electrical System > Immobilizer System > Troubleshooting

Diagnosis Of Immobilizer Faults

- Communication between the ECM and the SMARTRA.
- Function of the SMARTRA and the transponder.
- Data (stored in the ECM related to the immobilizer function).

The following table shows the assignment of immobilizer related faults to each type:

Immobilizer Related Faults	Fault types	Diagnostic codes
PCM(ECM) fault	1. Non-Immobilizer-EMS connected to an Immobilizer	P1610
Transponder key fault	1. Transponder not in password mode 2. Transponder transport data has been changed.	P1674 (Transponder status error)
Transponder key fault	1. Transponder programming error	P1675 (Transponder programming error)
SMARTRA fault	1. Invalid message from SMARTRA to PCM(ECM)	P1676 (SMARTRA message error)
SMARTRA fault	1. Virgin SMARTRA at learnt EMS 2. Neutral SMARTRA at learnt EMS 3. Incorrect the Authentication of EMS and SMARTRA 4. Locking of SMARTRA	P169A (SMARTRA Authentication fail)
SMARTRA fault	1. No response from SMARTRA 2. Antenna coil error	P1690 (SMARTRA no response)