



TRAINING MANUAL

Immobilizer System

CT-L1007



ZOOM-ZOOM

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Training Services



Introduction	00-1
Overview	01-1
Fundamentals	01-1
Immobilizer Systems Used By Mazda	01-2
Mazda Immobilizer System	01-2
Passive Anti-Theft System	01-3
I-PATS	01-3
D-PATS	01-4
Components	02-1
Overview	02-1
Transponder Key	02-2
Coil Antenna	02-4
Security Light	02-5
Powertrain Control Module.....	02-6
Immobilizer Module.....	02-7
Immobilizer Module Variants	02-8
Instrument Cluster.....	02-9
Immobilizer Function of the IC	02-10
Remote Keyless Entry Module.....	02-11
DDS1 Module.....	02-12
Diesel Smart Module.....	02-12
Variants	03-1
General Features	03-1
Precautions	03-2
Mazda Immobilizer System (from year 2000 onwards)	03-3
Design and Operation	03-3
Key ID-Number Verification Process	03-5
MIS Service Functions	03-6
MIS Service Function Table.....	03-6
Key Programming without Code Word.....	03-7
Key Programming with Code Word.....	03-8
Code Word Input Procedure	03-9
Code Word Request	03-10
Diagnosis	03-11
On-Board Diagnostic System.....	03-11
Security Light.....	03-11
DTCs Displayed by the Security Light	03-12
DTCs Displayed by WDS.....	03-13
Additional Troubleshooting Tips.....	03-14
Troubleshooting with Oscilloscope Signals.....	03-15
Transponder Signal	03-15
Communication Signal between Immobilizer Module and PCM	03-17

PATS	03-18
Design and Operation	03-18
Integrated PATS	03-18
Distributed PATS	03-20
Key ID-Number Verification Process.....	03-23
I-PATS	03-23
D-PATS	03-24
PATS Service Functions	03-26
I-PATS Service Functions Table.....	03-26
D-PATS Service Functions Table	03-27
Key Programming without WDS	03-29
Key Deletion without WDS.....	03-30
PATS Functions with WDS	03-31
Security Access	03-31
PATS Functions Menu	03-35
Items of the PATS Function Menu	03-37
Parameter Reset.....	03-38
Parameter Reset Procedure	03-38
Unlimited Key Mode.....	03-43
Diagnosis	03-44
On-Board Diagnostic System.....	03-44
Security Light.....	03-45
Diagnostic Trouble Codes	03-46
DTC Table	03-47
List of Abbreviations	04-1

Introduction

- Vehicle insurance companies demanded in the 90's an effective technical protection against car theft to be developed by the car manufactures. A primary requirement of the insurance companies was that the anti-theft system should activate itself automatically. Therefore, the car manufacturers developed the self-activating immobilizer system as an electronic anti-theft device. It prevents an engine start with an ignition key unknown to the immobilizer system. This means that the immobilizer function is only deactivated when the ignition is switched on with a registered key and activated automatically when the ignition is switched off.
- Since 1995, all Mazda passenger vehicles sold in Europe are equipped with an immobilizer system that meets these requirements. In the meantime, the technical progress has produced more sophisticated systems improving the protection against vehicle theft.
- The skills needed to diagnose and repair immobilizer system related concerns require fundamental system knowledge, because a malfunction can lead to a non-starting engine due to reasons, which might be not directly evident. This course is a theoretical and practical guide to gain general and Mazda specific knowledge about the various immobilizer systems, their components, function and diagnosis.
- Any person associated with the diagnosis and repair of immobilizer systems used on Mazda vehicles should have the knowledge to deliver a "Fix it right first time" repair. Therefore, the Mazda Masters Development and Qualification path provides the following training course required for the service on immobilizer systems:
 - Immobilizer System CT-L1007
- This training module contains training material about supplemental restraint systems and immobilizer systems as two separate topics. They are compiled for consecutive use in one training course but they can just as well be conducted as two separate courses.
- The ranking of this course within the Mazda Masters educational system is Level 1 - 'Mazda Technician'. It is focused on mechanics that have already experience in maintaining and repairing Mazda vehicles and have previously attended the courses "New-To-Mazda" CT-L1001 and "Basic Electrics" CT-L1004.

- The training manual Immobilizer System is divided into the following main chapters:
 - Overview
 - Components
 - Variants

NOTE: The data, tables and procedures represented in this training manual serve only as examples. They are taken from the service literature and subjected to major or minor changes in the course of time. To prevent any mis-diagnosis refer always to the current service literature while working on immobilizer systems.

Overview

Fundamentals

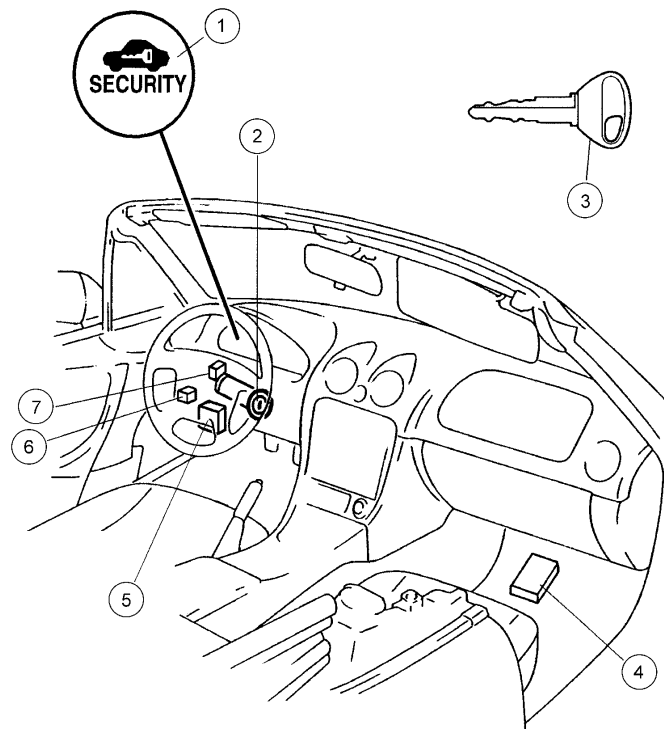
- The immobilizer system is a vehicle theft protection device that only allows an engine start with keys that have been registered previously. So it serves to prevent theft by means such as a forged key or electrical 'hotwiring'.
- During operation the engine start is prevented because the **PCM (Powertrain Control Module)** has not been activated to enable ignition, fuel supply / injection and starter. For their activation the PCM needs an enable signal that the right key is being used in the ignition lock.
- Therefore, each original key of the car is fitted with a microchip containing a unique **ID-number (IDentification-number)**, which is registered in the control module of the immobilizer system.
- The immobilizer system activates itself automatically when the ignition switch is turned to ACC or LOCK position. The system can only be deactivated with a registered key.
- Depending on the immobilizer type the security light signalizes system activation and malfunctions or only system malfunctions.
- All immobilizer systems used at Mazda are equipped with an **OBD (On-Board-Diagnostic)** function to detect, indicate and diagnose malfunctions.
- A detected malfunction can be indicated as a **DTC (Diagnostic Trouble Code)** by a corresponding flashing pattern of the security light and / or can be retrieved from the immobilizer control module with the aid of the **WDS (Worldwide Diagnostic System)**.

Immobilizer Systems Used By Mazda

- Mazda currently installs two basically different types of immobilizer systems:
 - Mazda Immobilizer System
 - Passive Anti Theft System

Mazda Immobilizer System

- On the **MIS (Mazda Immobilizer System)** the immobilizer control function is assigned to a separate immobilizer module, which is connected to the coil antenna, PCM and security light. This type has been the first immobilizer system used by Mazda in 1995. Over the years the system has been modified and extended with various functions. MIS is currently installed in the following models:
 - Premacy (CP)
 - MX-5 (NB)
 - B-Series (UN)
 - MPV (LW)



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MIS of MX-5 (NB)

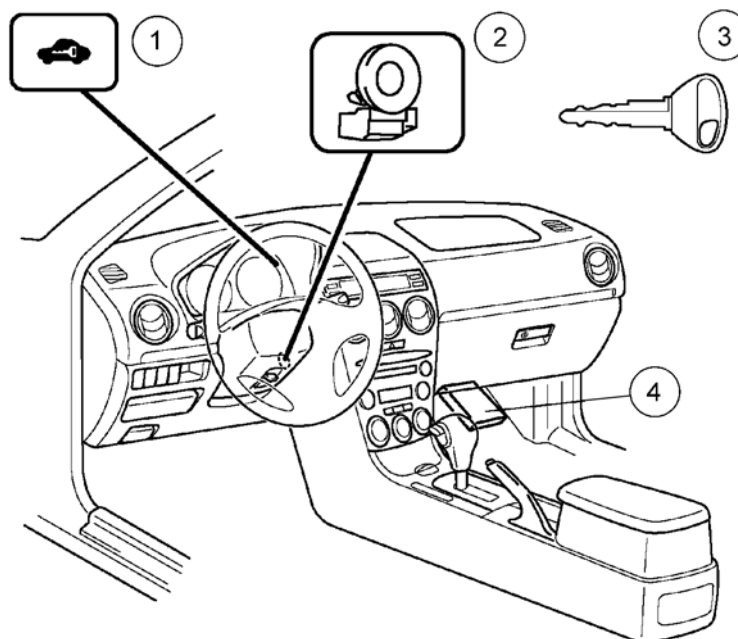
- | | | | |
|---|-----------------|---|---------------------|
| 1 | Security light | 5 | Immobilizer module |
| 2 | Coil antenna | 6 | Starter relay |
| 3 | Transponder key | 7 | Key reminder switch |
| 4 | PCM | | |

Passive Anti-Theft System

- The **PATS (Passive Anti-Theft System)** is an immobilizer system that has been developed by Ford and used for the first time by Mazda in 1996 for the 121 (ZQ). In the meantime PATS has run through several stages of development. Currently Mazda uses the following variants:
 - **I-PATS (Integrated PATS)**
 - **D-PATS (Distributed PATS)**

I-PATS

- The I-PATS is an integrated immobilizer system, i.e. the software and hardware required to control the PATS are incorporated in the PCM, which is connected to the coil antenna and the security light.
- I-PATS is currently installed in the following models:
 - Mazda6 (GG/GY)
 - Tribute (EP)



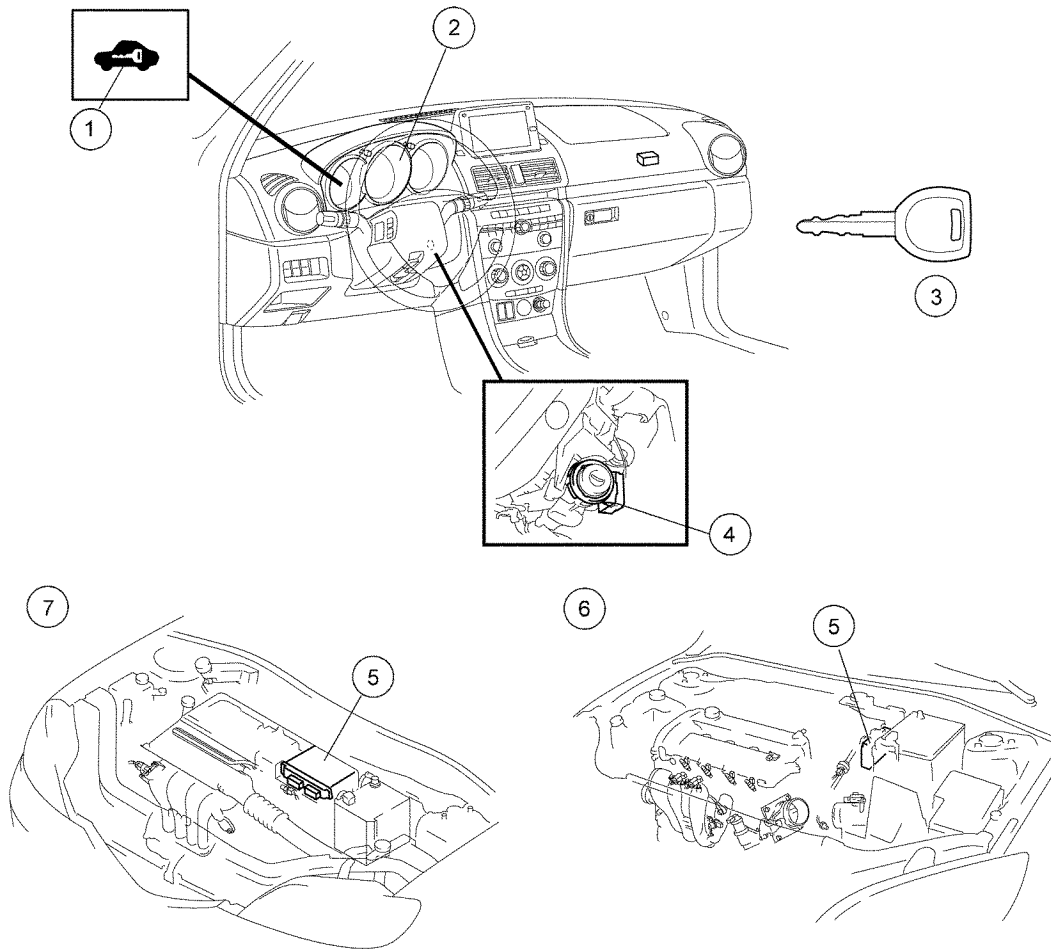
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I-PATS of Mazda6 (GG /GY)

- | | | | |
|---|----------------|---|-----------------|
| 1 | Security light | 3 | Transponder key |
| 2 | Coil antenna | 4 | PCM |

D-PATS

- The D-PATS represents the latest PATS development stage. Compared to I-PATS the control module requests a code from an additional module via the **CAN (Controller Area Network)** bus in order to increase the passive anti-theft protection.
- Currently three different layouts of D-PATS are installed in the following models:
 - Mazda3 (BK)
 - RX-8 (SE)
 - Mazda2 (DY)



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D-PATS of Mazda3 (BK)

- | | | | |
|---|--------------------|---|-----------|
| 1 | Security light | 5 | PCM |
| 2 | Instrument cluster | 6 | LF engine |
| 3 | Transponder key | 7 | Z6 engine |
| 4 | Coil antenna | | |

Components

Overview

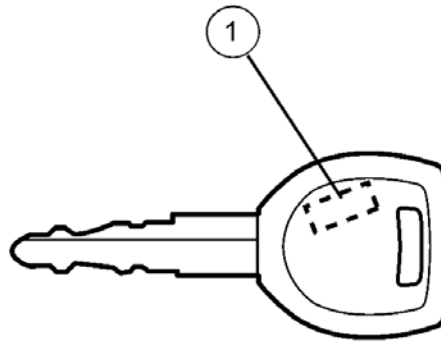
- The components that are used for the various Mazda immobilizer systems are described on the following pages:
 - Transponder key
 - Coil antenna
 - Security light
 - PCM
 - Immobilizer module
 - **IC** (Instrument Cluster) / **HEC** (Hybrid Electronic Cluster)
 - **RKE** (Remote Keyless Entry)
 - **DDS1** (Diesel-Diebstahl-Schutz) and **DSM** (Diesel Smart Modul)

- Components that require a specific programming procedure after replacement:
 - Transponder key
 - Immobilizer module
 - IC/HEC
 - RKE
 - PCM
 - DDS1 and DSM

NOTE: Always follow carefully the instructions of the **W/M** (Workshop Manual) and WDS regarding the respective programming procedure **before** you start replacing immobilizer components. Just replacing components will lead to a non-start concern that may provoke complications that cannot be solved easily.

Transponder Key

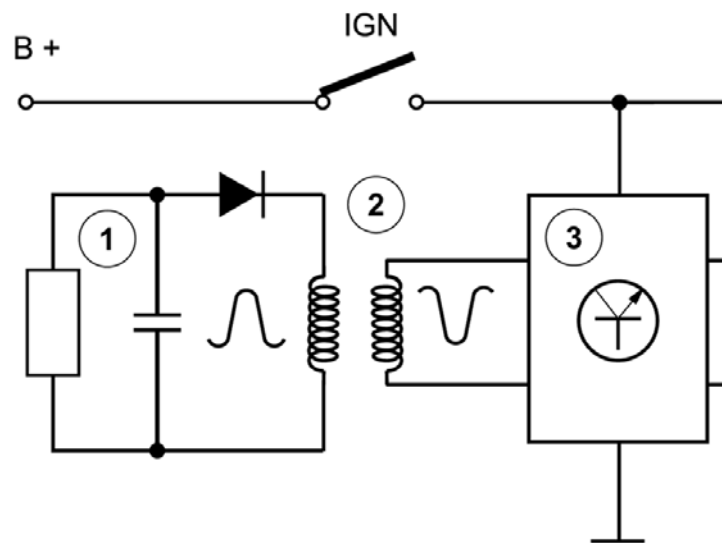
- Transponders (artificial word made up of TRANSMITTER / RESPONDER) belong to the group of electronic devices that operate according to the **RF-ID (Radio Frequency – Identification)** technology. Thereby the system consisting of transponder and reading unit enables a contactless detection and allocation of objects. The transponder is powered by inductive coupling so that no batteries are necessary.



1 Transponder

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- The transponder key has the transponder electronic integrated in its plastic handle where it is encapsulated in a glass or plastic body. It consists of:
 - A microchip that contains the unique key ID-number. Due to an encrypted request signal from the immobilizer control module the chip calculates a matching code for the ID-number before it is transferred. To prevent an unauthorized scanning of the ID-number the code changes with each transfer and uses several million different coding possibilities.
 - A coil, which transfers and receives all data signals to and from the immobilizer control module via the coil antenna / transceiver.
 - A capacitor that powers the transponder electronic and is charged by inductive coupling through the coil antenna / transceiver.



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Inductive coupling of transponder and coil antenna

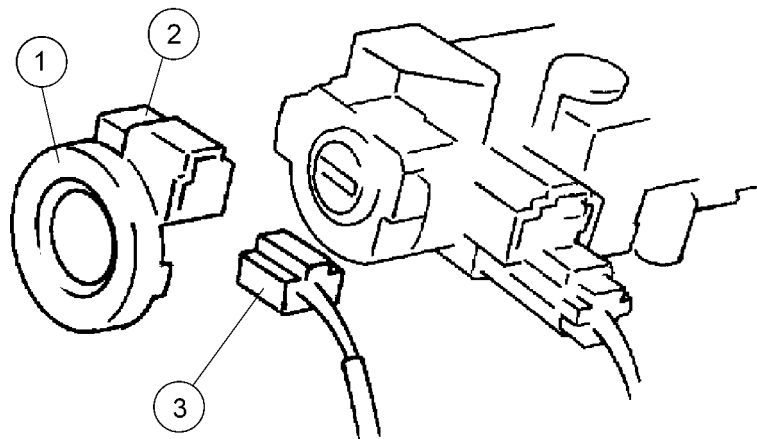
- | | | | |
|---|------------------------------|---|-------------|
| 1 | Transponder with integral IC | 3 | Transceiver |
| 2 | Transmission distance (HF) | | |

NOTE: Each transponder key must be registered to the system using a specific programming procedure. Key programming procedures are described in the chapter “Immobilizer Systems” and in the respective W/M.

NOTE: The type of transponder key varies depending on the installed immobilizer system. In case a new transponder key is needed order the matching type by means of the **VIN** (Vehicle Identification Number) and the **EPC** (Electronic Parts Catalogue). Use only the correct type of transponder key approved by Mazda. Otherwise key programming is impossible.

Coil Antenna

- The coil antenna powers the transponder by inductive coupling and *transmits / receives* the data signals between control module and transponder key by radio frequencies. It is sometimes also designated as coil antenna / transceiver.
- The coil antenna consists of a copper coil wound up in a ring case and an integrated circuit to create a high-frequency alternating voltage for the inductive coupling.
- It is installed around the entry to the mechanical lock cylinder and connected to the control module of the immobilizer system.
- The transceive operation starts when the ignition key is switched to the ON position. On the MIS (from year 2000 onwards) the transceive operation already starts when the key has been inserted in the keyhole i.e. the process is initialized by the key reminder switch.



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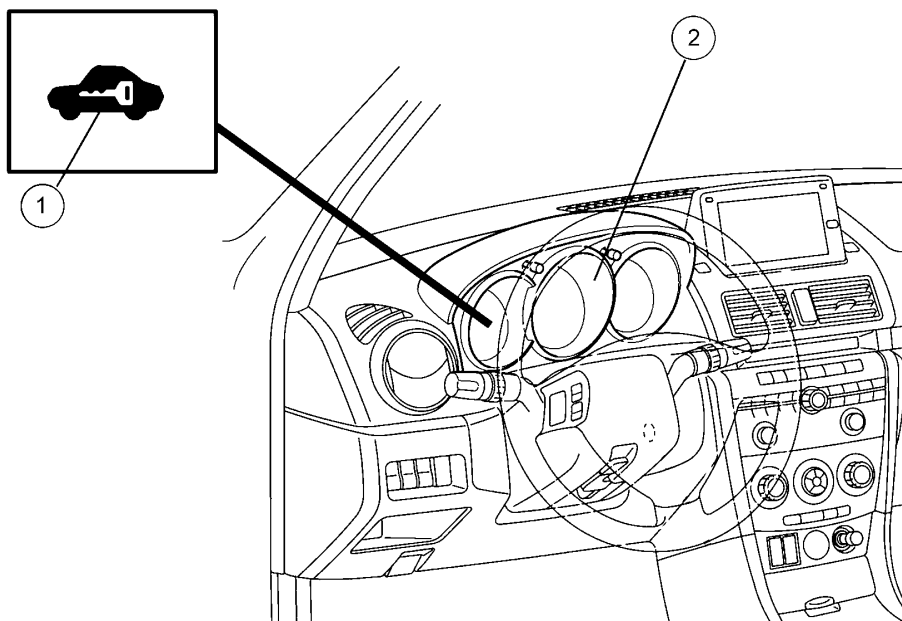
Coil antenna

- | | | | |
|---|-------------------------|---|-----------|
| 1 | Coil | 3 | Connector |
| 2 | Transceiver electronics | | |

NOTE: The coil antenna is a purely transmitting component. It does not need to be programmed to the immobilizer system in case of replacement.

Security Light

- The security light is used to indicate system activation (only on PATS) as well as malfunctions.
- The system activation is displayed by a constant flashing light, while malfunctions are indicated by specific flashing patterns or constant illumination.
- The current Mazda vehicles with immobilizer system have the security light located in the IC.
- The security light is powered by the IC and controlled by the respective immobilizer control module on the ground side.
- On the MIS the code word is entered with the aid of the security light.



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1 Security light

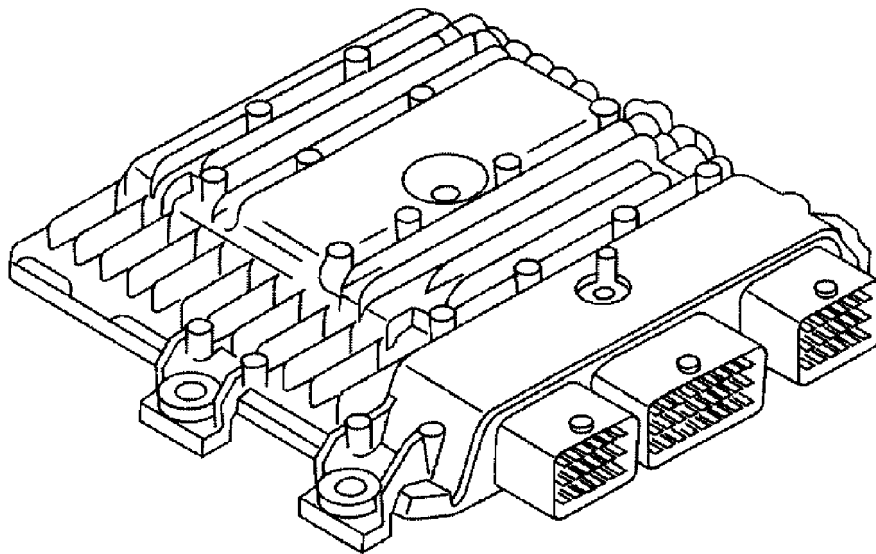
2 IC

NOTE: Refer to the section „Immobilizer Systems“ and the respective W/M for more information about flashing patterns of the security light.

NOTE: Depending on the vehicle specification the security light also indicates the activation of the double lock function of the power door lock and / or of the theft deterrent system. However, these systems are not linked to any immobilizer function.

Powertrain Control Module

- The PCM is generally involved in the immobilizer systems used on Mazda vehicles. On petrol engines it controls the activation of fuel injection, ignition and starter for the engine start according to an inhibit- or enable signal from the immobilizer system. The PCM of the current diesel engines activates starter, injectors and depending on the installed system other injection components as e.g. the fuel-metering valve.
- The PCM can have different functions within the immobilizer system:
 - The immobilizer control function is integrated in the PCM, which is directly connected to the coil antenna / transceiver.
 - The immobilizer control function is integrated in a separate immobilizer module while the PCM operates as additional verification component for the ID-number and the code word.
 - The immobilizer control function is integrated in the IC or RKE module while the PCM operates as additional verification component to increase anti-theft protection.
 - The immobilizer control function of the Mazda2 is integrated in the PCM, while the IC operates as additional verification component.

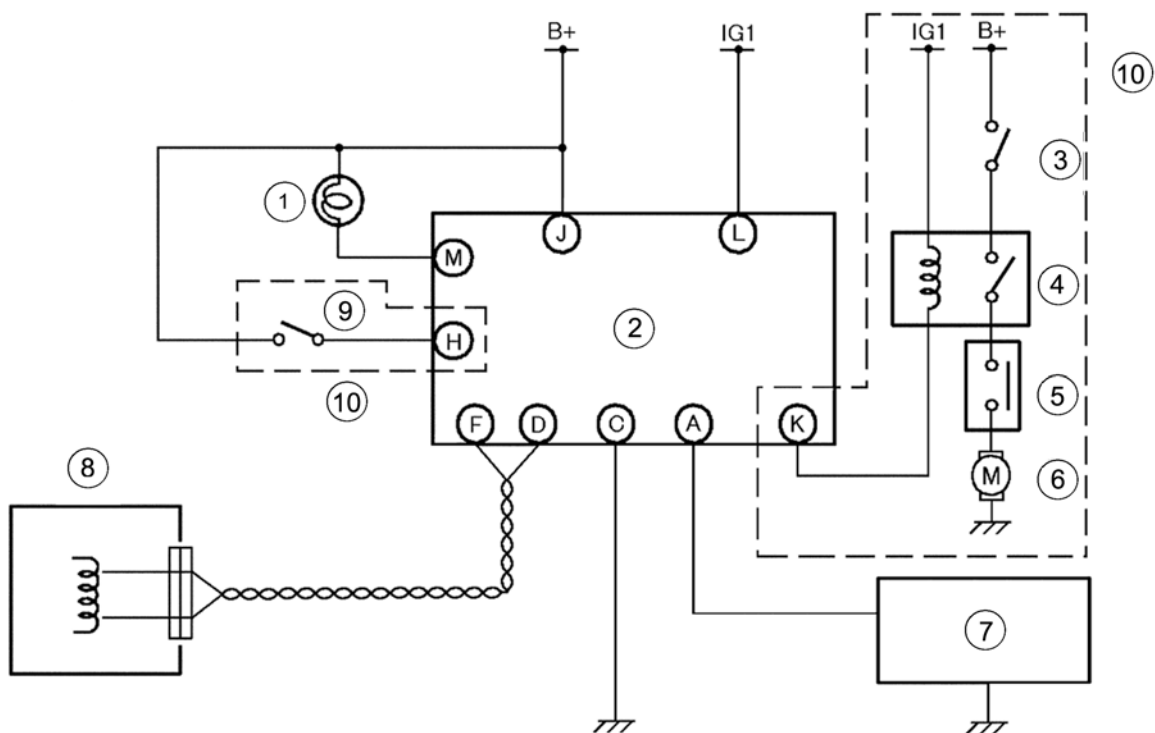


PCM of Mazda2

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Immobilizer Module

- The immobilizer module controls the function of the MIS. It consists of a printed circuit board with a memory chip attached to it. The module is a sealed unit that cannot be repaired.
- The immobilizer module of the current MIS is connected to the:
 - Coil antenna / transceiver
 - PCM
 - Security light in the IC
 - Key reminder switch
 - Starter circuit
 - Ignition switch, B+ and ground



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MIS wiring diagram of MPV (LW)

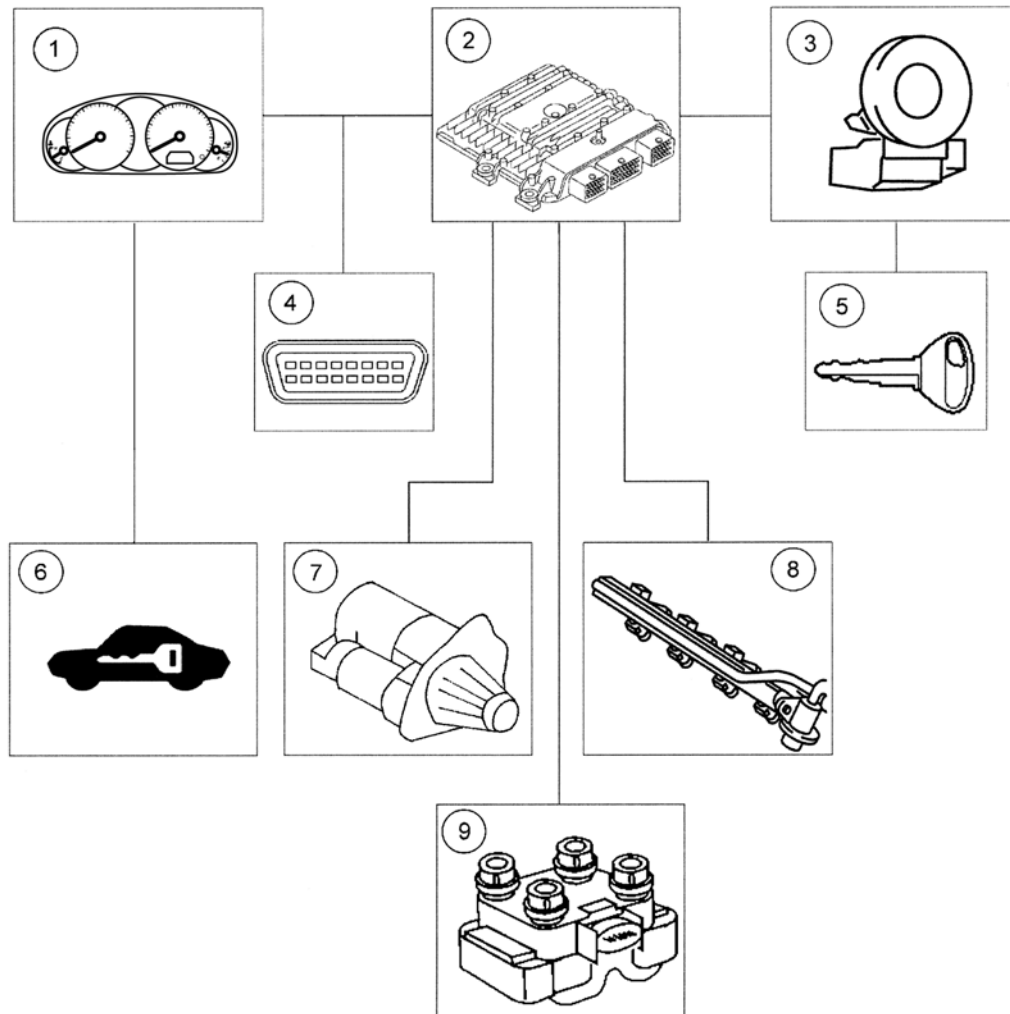
- | | | | |
|---|----------------------------------|----|------------------------|
| 1 | Security light | 6 | Starter |
| 2 | Immobilizer module | 7 | PCM |
| 3 | Ignition switch (start position) | 8 | Coil antenna |
| 4 | Starter relay | 9 | Key reminder switch |
| 5 | TR switch (ATX) | 10 | From year 2000 onwards |

Immobilizer Module Variants

- Depending on the respective MIS generation the immobilizer module features various functions:
 - The first MIS generation uses a “Temic” immobilizer module (since model year 1995): - Engine is shut off two seconds after the start if a malfunction has been detected during the verification of ID-number and / or code word.
 - The second MIS generation uses a “Lucas” or “Mitsubishi” immobilizer module (since model year 1997): - Its operation is as per the first generation but in case of an immobilizer malfunction the engine start is prevented after three starting attempts. Thereafter the engine is just cranked but not started.
Since 1998 a random code encryption of the ID-number transfer between transponder and immobilizer module has been adopted for all MIS.
 - The third MIS generation uses a “Lucas” or “Mitsubishi” module (since model year 2000) – its operation is as per the second generation but in addition it generally prevents starter operation when using an unregistered key or when a system malfunction has been detected. Moreover, the verification process already starts when the ignition key is inserted.

Instrument Cluster

- To increase anti-theft protection the PATS of the Mazda2 (DY) and the Mazda3 (BK) comprise the IC as additional component.
- The IC of Mazda2 is connected to the PCM and **DLC (Data Link Connector)**, while the IC of the Mazda3 is connected to the PCM, DLC and coil antenna.



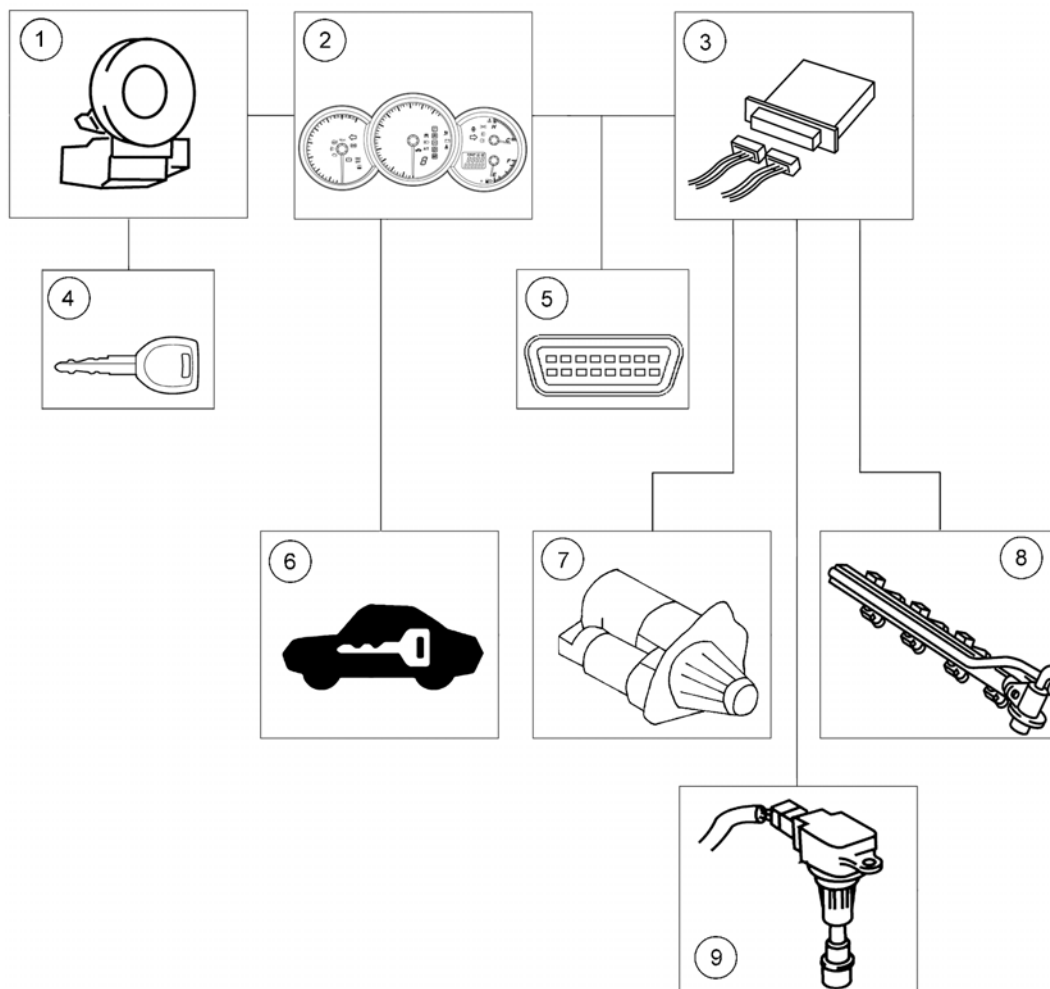
PATS of Mazda2 (DY)

- | | | | |
|---|-----------------|---|----------------|
| 1 | IC | 6 | Security light |
| 2 | PCM | 7 | Starter |
| 3 | Coil antenna | 8 | Fuel injectors |
| 4 | DLC | 9 | Ignition coil |
| 5 | Transponder key | | |

1007_005a

Immobilizer Function of the IC

- The ICs of Mazda2 (DY) and Mazda3 (BK) have the following differences:
 - On the Mazda2 the PCM controls the immobilizer function and starts initializing the verification process of the ID-number. In addition the ID-number and a specific code are exchanged with the IC via CAN bus to increase anti-theft protection.
 - On the Mazda3 the IC controls the immobilizer function and initializes the verification process of the ID-number. In addition the ID-number and a specific code are exchanged with the PCM via CAN bus to increase anti-theft protection.



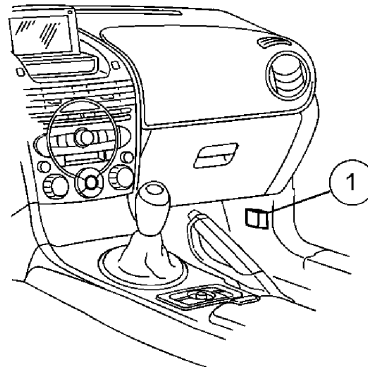
PATS of Mazda3 (BK)

- | | | | |
|---|-----------------|---|---------------------|
| 1 | Coil antenna | 6 | Security light |
| 2 | IC | 7 | Starter |
| 3 | PCM | 8 | Fuel injectors |
| 4 | Transponder key | 9 | Electronic ignition |
| 5 | DLC | | |

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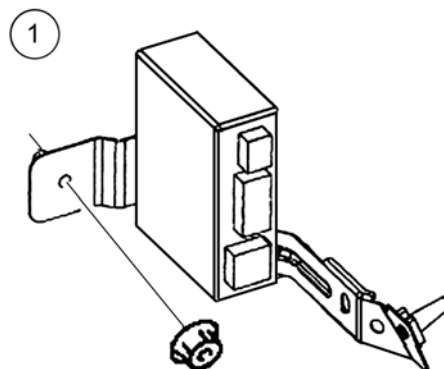
Remote Keyless Entry Module

- Like the IC on the Mazda3 (BK) the RKE module comprises the PATS control function and other functions for the body electrical system. It also compares the ID-number and interchanges a specific code with the PCM via the CAN bus.
- The immobilizer function of the RKE module is the same as of the Mazda3 IC.
- The RX-8 (SE) is currently the only Mazda model that is equipped with a RKE module.



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Location of RKE module



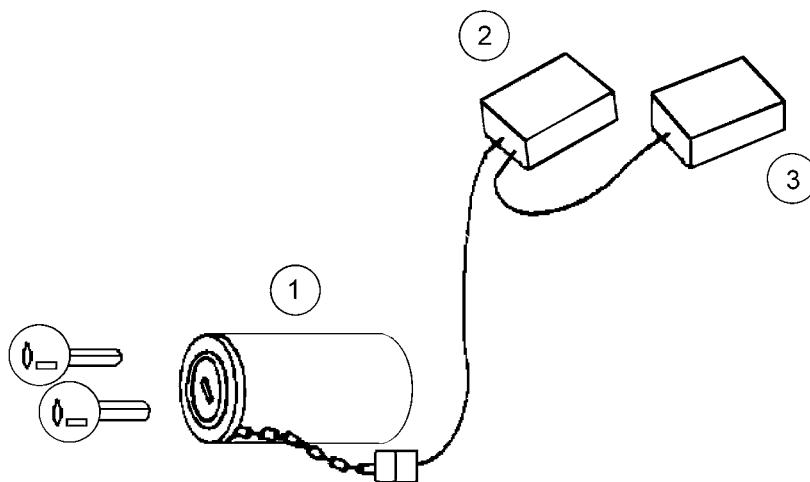
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1 RKE module

NOTE: The keyless entry system, which is also controlled by the RKE module, is not linked to any immobilizer function.

DDS 1 Module

- The MIS for diesel models equipped with a mechanical distributor-type injection pump (B-2500 UN, MPV LV) use the DDS1 (carried over from the German term “**Diesel-Diebstahl-Schutz**”) module to control the fuel shut-off valve depending on the enable signal from the immobilizer module. The DDS1 module is an inherent part of the injection pump and accomplishes a similar function as the PCM within the MIS for gasoline engines.



1007_009

- 1 Coil antenna
- 2 Immobilizer module

- 3 DDS1 module

Diesel Smart Module

- The **DSM (Diesel-Smart-Module)** is installed in the 121 (ZQ) with the Endura DE engine, which is equipped with a mechanical distributor-type injection pump. The PATS of this model uses a separate immobilizer module just like the MIS. The DSM is also an inherent part of the injection pump and controls the fuel shut-off valve depending on an enable signal from the immobilizer unit. The function and operation of the DSM is the same as per the DDS1.

NOTE: DDS1 and DSM are not available as spare parts. They need to be replaced together with the fuel injection pump. In that case contact the Technical Hotline or the Technical Service Department. They will decide whether it might be necessary to send in the injection pump or to order a new one. Refer to the respective W/M to gain more information about the immobilizer system of these models.

Variants

General Features

- The immobilizer systems introduced in the chapter “Overview” basically operate according to the same principle. Although they require different procedures for component replacement and diagnosis, they have some features in common:
 - All immobilizer systems require at least two registered keys for system operation and can register a maximum of eight keys. An exemption is the PATS installed in the first 121 (ZQ until 1998), which requires three keys at minimum and can register a maximum of 16 keys.
 - Each system allows programming of additional keys when two registered keys are available (for PATS the function “Customer Spare Key Programming” must be enabled).

NOTE: In case an ignition key is lost or stolen, the customer should contact a Mazda dealer or authorized repairer to have the key deleted.

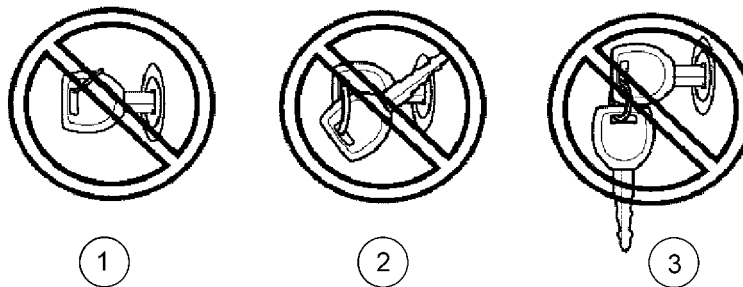
NOTE: Before you begin the diagnosis or repair of the immobilizer system, always check whether any service information has been published concerning the malfunction.

NOTE: To avoid problems during the replacement of immobilizer components, it is important to order the required spare parts according to the VIN and the serial number of the immobilizer module.

- Additional information about the current immobilizer systems can be found in the following sections of the respective W/M:
 - Section “T and F” in the W/M with former layout. Information about immobilizer systems installed on models before 1997 can be found in W/M 1503-10-95.
 - Section “Body & Accessories→Security and Locks”, “Body & Accessories→On-Board Diagnostic [Immobilizer System]” and section “Engine→On-Board Diagnostic [Engine Control System]” in the W/M on the CD-ESI – (MIS and PATS).
 - Section 4: “Electrical”→”Electronic Feature Group” – on the Service Manual CD for Mazda2 (PATS).

Precautions

- To avoid damage to the key, do not:
 - Drop the key
 - Get the key wet
 - Expose the key to any kind of magnetic field
 - Expose the key to high temperatures on places such as the instrument panel or bonnet, under direct sunlight.
- A system malfunction may occur if any of the following items are touching or are near the key head.
 - Any metallic object
 - Spare keys or keys for other vehicles equipped with an immobilizer system
 - Any electronic device, or any credit or other cards with magnetic strips



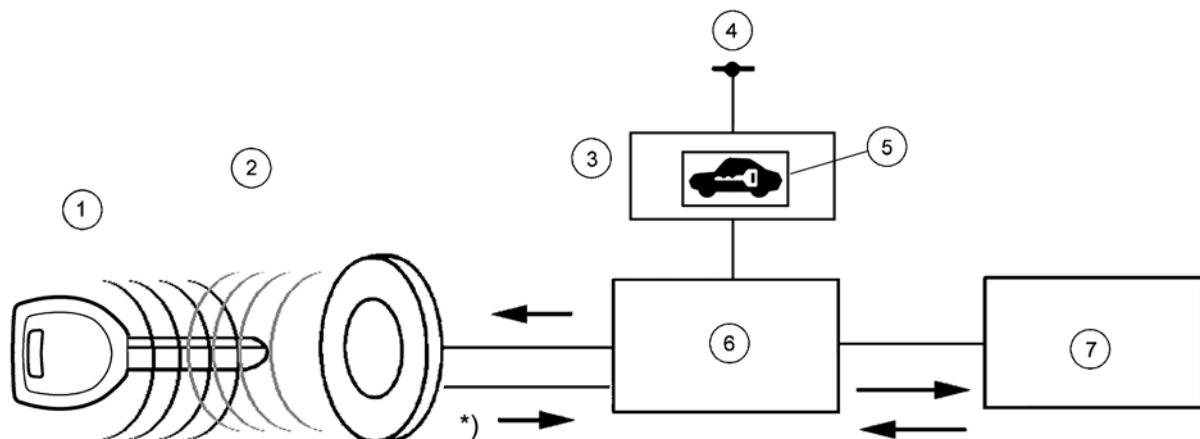
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- | | | | |
|---|---|---|--|
| 1 | Metal ring lying on key head | 3 | Key is near or touching another immobilizer system key |
| 2 | Metal part of another key touching key head | | |

Mazda Immobilizer System (from year 2000 onwards)

Design and Operation

- The MIS consists of transponder key, coil antenna, key reminder switch, separate immobilizer module, PCM and security light.
- The key ID-numbers are stored in a non-volatile memory of the immobilizer module. At each start the module compares the ID-number of the transponder key used with those stored in the memory.
- If the verification has been successful, the immobilizer module sends a request signal to the PCM to compare the key ID-number with the numbers registered in the PCM.
- Each immobilizer module has its unique code word that is stored in the PCM during its installation. After the verification of the ID-number the immobilizer module requests the code word from the PCM.
- The immobilizer module controls the starter circuit and the security light. It enables the PCM to activate fuel injection and ignition when the ID-number and code word verification have been successful.
- The signals between immobilizer module and PCM are transmitted via a bi-directional line.



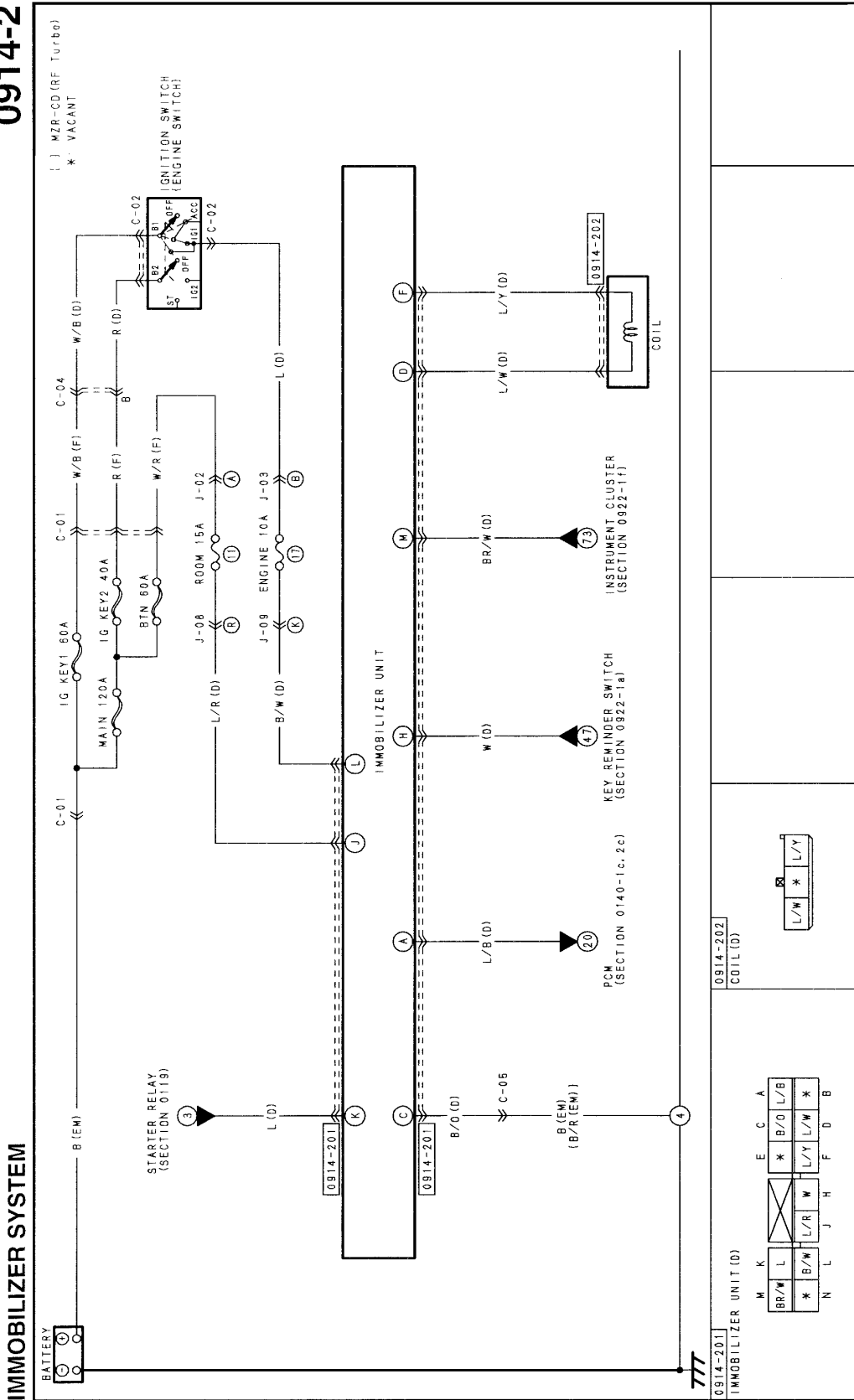
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MIS components

- | | | | |
|---|--------------------|---|--------------------|
| 1 | Transponder key | 5 | Security light |
| 2 | Coil antenna | 6 | Immobilizer module |
| 3 | Instrument cluster | 7 | PCM |
| 4 | B+ | | |

*) The arrows in the picture above indicate the signal flow during the ID-number verification.

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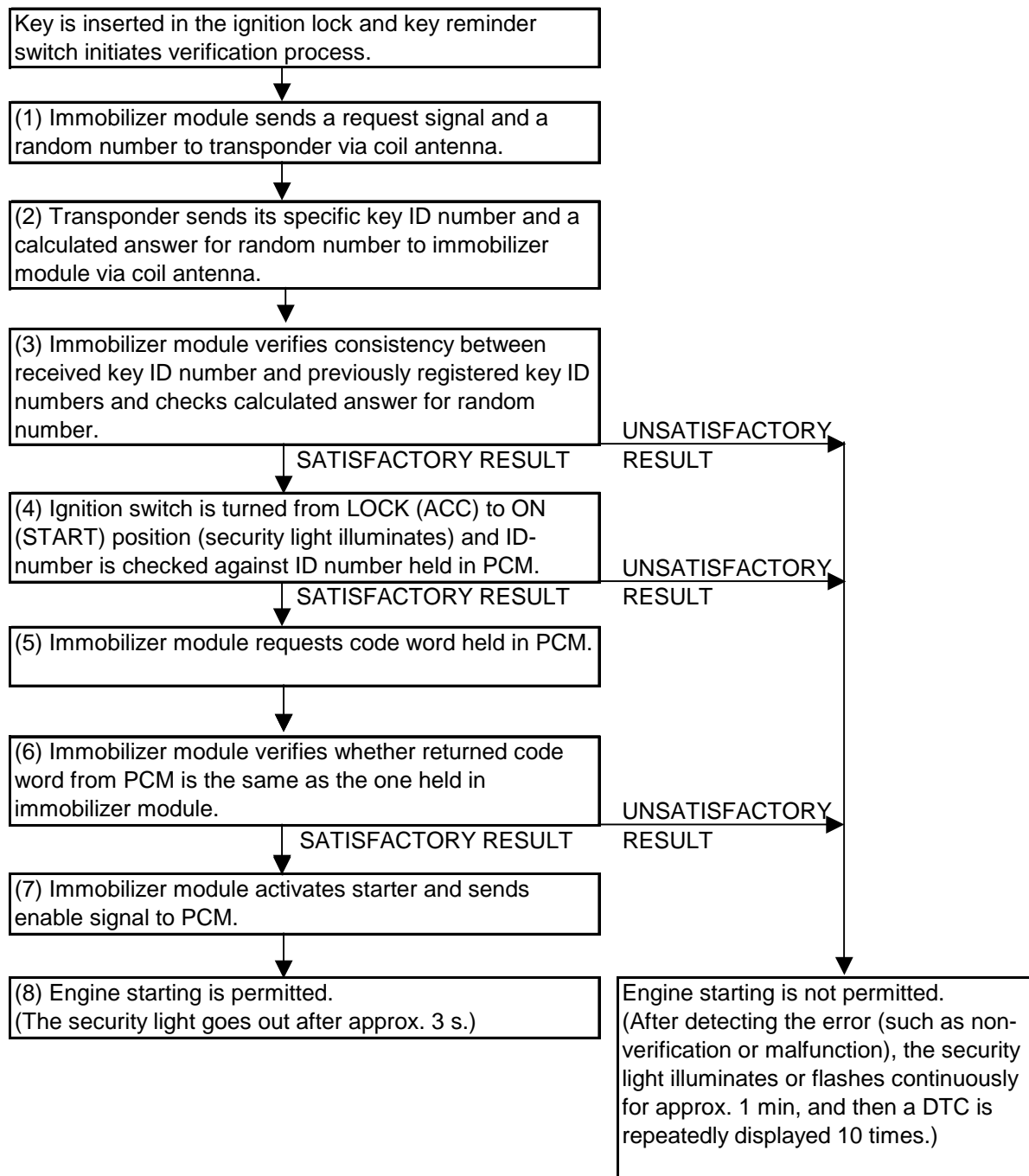


Wiring diagram of the MIS (MPV LW)

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Key ID-Number Verification Process

- The flowchart shows the ID-number verification process of the current MIS (MPV LW).



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MIS Service Functions

- When you replace MIS components (key, immobilizer module, PCM) follow the detailed procedures as indicated in the respective W/M.
- The customer should bring all keys to the dealer if components are replaced. This is necessary because each previously registered key is deleted when it is not used during the key programming procedure.
- If the immobilizer module or the PCM is replaced, there must be at least one valid key. Otherwise, the immobilizer module **and** the PCM must be replaced.
- Neither the immobilizer module nor the PCM can be changed from one vehicle to another. If the immobilizer module or the PCM is replaced by one from another vehicle, the engine will not start. It is not possible to re-use an immobilizer module or a PCM that has already been programmed to another vehicle.
- Consequently, the immobilizer module and / or the PCM should not be replaced on trial during troubleshooting. If this is done, the ID-number and the code word will be programmed into the new module so it becomes unusable for other vehicles, even if you find that the old one has no malfunction.
- The exchange of the immobilizer module always requires the code word to be entered, while the PCM can be exchanged without code word when two registered keys exist.

MIS Service Function Table

Item	No Valid Key	One Valid Key Exists	More Than One Valid Key Exists
Key Addition / replacement	Code word input	Code word input	Use valid keys to program new keys.
Ignition Lock replacement	Code word input	Code word input	Code word not necessary. Follow procedure in the W/M using old keys and new keys.
Immobilizer module replacement	Replace both PCM and immobilizer module. Follow procedure for PCM and immobilizer replacement.	Code word input	Code word input
PCM replacement	Replace both PCM & immobilizer module. Follow procedure for PCM & immobilizer replacement.	Code word input	Follow procedure for PCM to learn valid keys.

1007_T002

Key Programming without Code Word

- Two keys are required to program 6 additional keys according to the following procedure:
 1. Insert key 1 into the steering lock for at least 1 second.
 2. Pull out the key for approximately 1 cm and insert it again constantly five times at no more than 1-second-intervals. After the final key insertion verify that the security light illuminates.
 3. Remove the key from the steering lock. Verify that the security light goes out.
 4. Insert key 2 into the steering lock and turn the key to the ON position. Verify that the security light illuminates for 1 to 2 seconds.
 5. When the security light has gone out, turn the key to the LOCK position and remove it from the steering lock.
 6. Insert key 3 into the steering lock and turn it to the ON position. Verify that the security light illuminates for 1 to 2 seconds.
 7. When the security light has gone out, turn the key to the LOCK position and remove it from the steering lock. Program all further keys according to step 6 and 7.
 8. Wait for 30 seconds before you start the vehicle with all keys to verify the correct function. When confirming wait for more than 5 seconds before inserting the next key.
 9. After successful key programming, check PCM for stored DTCs.



- 1 Valid keys
- 2 Key 1
- 3 Key 2

- 4 New key
- 5 Key 3

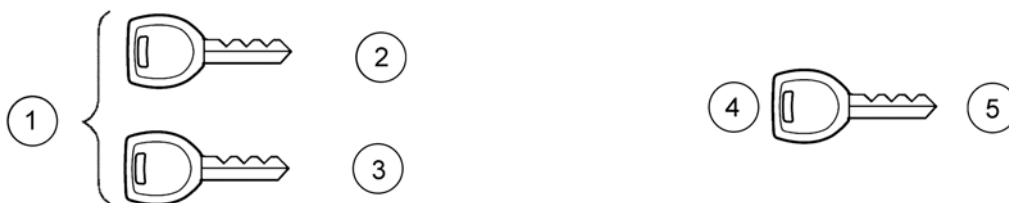
1007_013

NOTE: Each step should be performed within 30 seconds after the previous step.

NOTE: If the key cannot be registered although the immobilizer system operates normal, there may be a malfunction with the key reminder switch or wiring harness.

Key Programming with Code Word

- The programming of additional keys requires a code word to be entered if only one key exists. With one registered key 7 additional keys can be programmed according to the following procedure:
 1. Insert key 1 into the steering lock for more than 1 second.
 2. Pull out the key for approximately 1 cm and insert it again five times at no more than 1-second-intervals. After the final key insertion verify that the security light flashes (300 ms ON - 300 ms OFF).
 3. Wait for 5 minutes until the security light flashing frequency has slowed down to 1.2-second-intervals.
 4. Input the code word, (refer to the next page).
 5. After verifying that the security light has changed from flashing to illumination, turn the key to the ON position.
 6. When the security light has gone out, turn the key to the LOCK position and remove it from the steering lock.
 7. Insert key 2 into the steering lock and turn it to the ON position. Verify that the security light illuminates for 1 to 2 seconds. After the security light has gone out, turn the key to the LOCK position and remove it from the steering lock.
 8. Insert key 3 into the steering lock and turn it to the ON position. Verify that the security light illuminates for 1 to 2 seconds.
 9. After the security light has gone out, turn the key to the LOCK position and remove it from the steering lock. Program all further keys according to step 8 and 9.
 10. Wait for 30 seconds before you start the vehicle with all keys to verify the correct function. When confirming wait for more than 5 seconds before inserting the next key.
 11. After successful key programming, check PCM for stored DTCs.



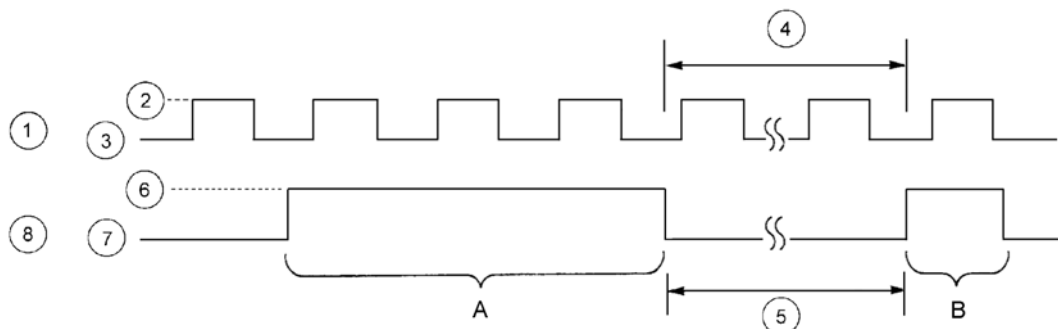
- 1 New keys
- 2 Key 1
- 3 Key 2

- 4 Valid or new key
- 5 Key 3

1007_014

Code Word Input Procedure

- A code word is composed of eight digits from 0 – 9. The manufacturer has programmed it as unique figure into the immobilizer module.
- When you have entered the mode for inputting the code word with an **unregistered** key according to the procedure described on the preceding page, wait for 5 minutes until the security light flashes slowly (flashing frequency changes from 300 ms ON / 300 ms OFF to 1.2 s ON / 1.2 s OFF).
- Input the code word according to the following procedure as shown in the example for the code word digits “3” and “1”:
 1. Turn ignition switch to the ON position while the security light is **OFF** and count three illumination cycles. When the light is **OFF** after the third illumination, turn the key to the LOCK position.
 2. Wait at least one illumination cycle.
 3. Then turn the ignition switch to the ON position (within 30 seconds) while the security light is **OFF** and count one illumination cycle. While the light is **OFF** after the first illumination, turn the key to the LOCK position.
 4. Repeat step (2) for the remaining six digits.
 5. When the code word is correctly registered in the PCM, the security light stops flashing and illuminates. Carry on with the respective programming step.



1007_015

Inputting the code word “3” and “1”

1	Security light	6	On
2	On	7	Lock
3	Off	8	Ignition switch
4	One cycle or more	A	Code word “3”
5	Within 30 seconds	B	Code word “1”

NOTE: The number “0” in a code word requires 10 illumination cycles.

NOTE: If a wrong number of the code word is entered, the security light goes out at the end of the procedure. If the input procedure has been incorrect the security light turns off at once. In both cases remove and insert the key five times as described before and repeat the code word input procedure.

Code Word Request

- Most programming procedures of the immobilizer system require entering the code word as previously described. The code word is available at your Technical Hotline / Service Department.
- To obtain the code word the Mazda dealer must fill in a prepared request form and fax it to his NSC / ID. Amongst other data the request form must contain the serial number of the immobilizer module and the VIN.
- The serial number consists of a 10-digit number and is located above the barcode on the immobilizer module label (see arrow in the picture below).



Serial number of a Mitsubishi immobilizer module

1007_016

Diagnosis

On-Board Diagnostic System

- The **On-Board Diagnostic (OBD)** function of the MIS comprises a malfunction detection function and diagnosis function that start operating automatically when the ignition switch is turned to the ON position.
- The OBD system monitors the function of the different components and the signal transfer between them. A present malfunction is displayed by the security light and / or is stored in the PCM as DTC.
- DTCs for the immobilizer system are cleared when the ignition switch is turned from the ON to the LOCK or ACC position.





NOTE: Always start troubleshooting with the inspection of both the security light *and* the DTC memory of the PCM with WDS. Some DTCs are only indicated by the security light while other DTCs are only displayed by the WDS. Moreover it is possible that the security light may not properly display a DTC if it has a malfunction itself. Therefore use WDS for the troubleshooting on MIS in any case.

Security Light

- The security light of the MIS is controlled by the immobilizer module as follows:
 - The activation of the immobilizer system is not displayed by the security light.
 - The immobilizer function is de-activated when the security light turns off approximately 2 seconds after the engine start.
 - If the immobilizer function is not de-activated (malfunction detected by the OBD function), the security light flashes a DTC within two minutes.

DTCs Displayed by the Security Light

- The security light displays present malfunctions by flashing a corresponding two-digit code. The available DTCs indicate malfunctions of the ID-number verification between transponder key and immobilizer module and malfunctions of the communication between PCM and immobilizer module.
- To display a DTC by the security light follow the procedure below.
 1. Turn the ignition switch to START position **for 2 seconds**, then back to ON position.
 2. Wait for **2 minutes**.
 3. Verify the security light condition and if a DTC is indicated, go to the respective troubleshooting chart.

DTC	Output pattern	Description	Page
1		ID number unregistered in immobilizer unit is input after ignition switch is turned to ON position or engine cranking.	(See T-87 DTC 01)
2		ID number format error (voltage range, frequency)	(See T-87 DTC 02)
3		ID number is not input into immobilizer unit after ignition switch is turned to ON position or cranking engine.	(See T-87 DTC 03)
11		Coil or wiring harness between immobilizer unit and coil is open circuit.	(See T-88 DTC 11)

1007_T003

Excerpt of DTC Table from MPV (LW 2003)

NOTE: The DTC table and troubleshooting charts for these DTCs can be found in W/M section “T→Immobilizer System” and on the CD-ESI in section “Body & Accessories → On-Board Diagnostic [Immobilizer System]”

DTCs Displayed by WDS

- The PCM detects malfunctions related to the ID-number / code word verification or to the communication between immobilizer module and PCM. A malfunction can be retrieved by WDS as five-digit DTC.
- To display DTCs with WDS follow the procedure below.
 1. Connect WDS to the DLC.
 2. Turn ignition switch to start.
 3. Select “Self Test → Modules → PCM” to retrieve all stored DTCs from the PCM.
 4. Carry out repair or continue diagnosis for the retrieved DTCs according to the instructions in the W/M.

DTC	Description
P1602	Immobilizer unit-PCM communication error
P1603	Key ID numbers are not registered in PCM
P1624	Immobilizer system communication counter = 0

1007_T004

Excerpt of five digit DTCs of the MIS

NOTE: The DTC table and appropriate troubleshooting charts can be found in W/M section “F → Fuel and Emission Control Systems” and on the CD-ESI in section “Engine → On-Board Diagnostic [Engine Control System]”

NOTE: DTC P1624 always occurs when the PCM has detected a malfunction more than three times during starting. The DTC is automatically deleted when the malfunction has gone.

NOTE: If the immobilizer system has an intermittent malfunction, inspect the respective wiring pins for tight seat / good contact and the wiring for any open or short circuit. Refer also to W/M section “General Information → Electrical Systems”.

NOTE: When the engine does not start or starts but stalls afterwards, and no DTC is indicated neither by the security light nor the WDS, the malfunction is most likely not related to the immobilizer system. In this case you will find supporting information in the W/M section “Engine Symptom Troubleshooting”. In addition there are further diagnostic possibilities that are described in the next section.

Additional Troubleshooting Tips

- If a malfunction of the MIS cannot easily be identified by inspection of the security light or by a DTC logged in the PCM, carry on with troubleshooting as follows:
 - First check power supply and ground connection of all immobilizer components.
 - If ok, insert the transponder key five times and observe the security light. The following results are possible:
 1. The security light is illuminated: The key ID-number is valid and the malfunction can be caused by the PCM, the immobilizer module or the wiring between them.
 2. The security light flashes constantly: The ID-number is not registered and should be reprogrammed.
 3. The security light is not illuminated, caused by a malfunction of one or more of the following components:
 - Control circuit of the security light
 - Transponder of the key
 - Coil antenna
 - Immobilizer module
 - Wiring between coil antenna and immobilizer module

NOTE: This test should be performed with all vehicle keys.

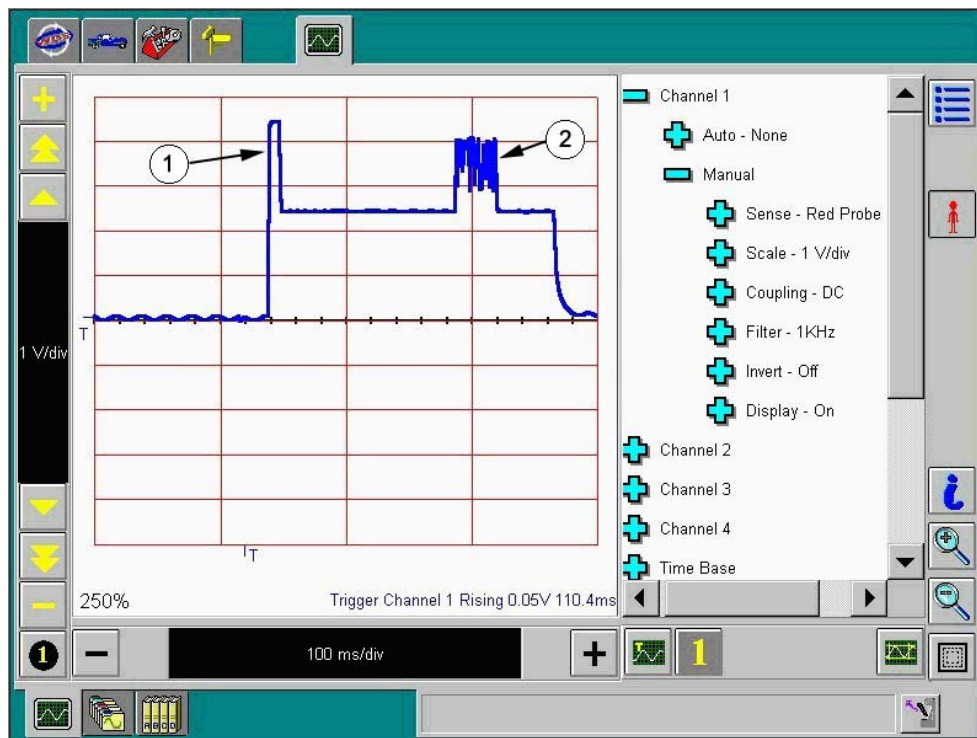
Troubleshooting with Oscilloscope

- If the procedures described on the preceding pages do not help in identifying the malfunction, check the signals of the immobilizer system with an oscilloscope (e.g. WDS) and compare them with the signals shown on the pictures below.

NOTE: The background and signal colors of the following oscilloscope images have been inverted to increase the clarity of the graph.

Transponder Signal

- Good signal of a valid key measured at terminal “F” of the immobilizer module.



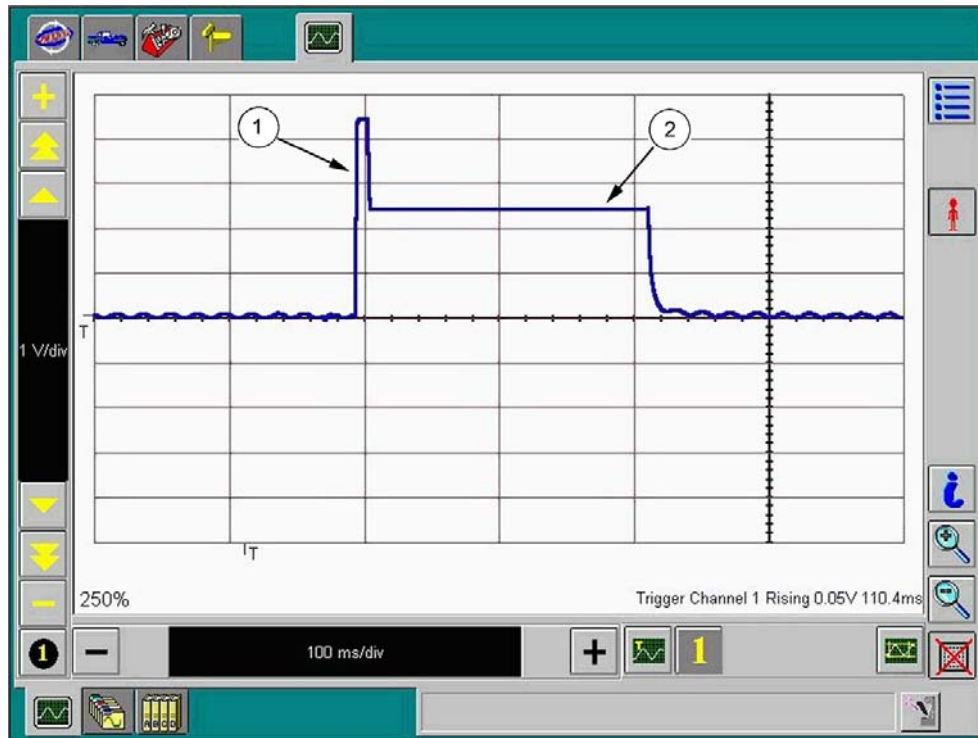
1007_S001

1 Signal start

2 Valid transponder signal

NOTE: The signal was recorded with the oscilloscope settings that are visible on the screenshot. The signal will only be displayed as shown above when the noise filter is set to 1 kHz.

- Signal of an invalid key measured at terminal “F” of the immobilizer module.



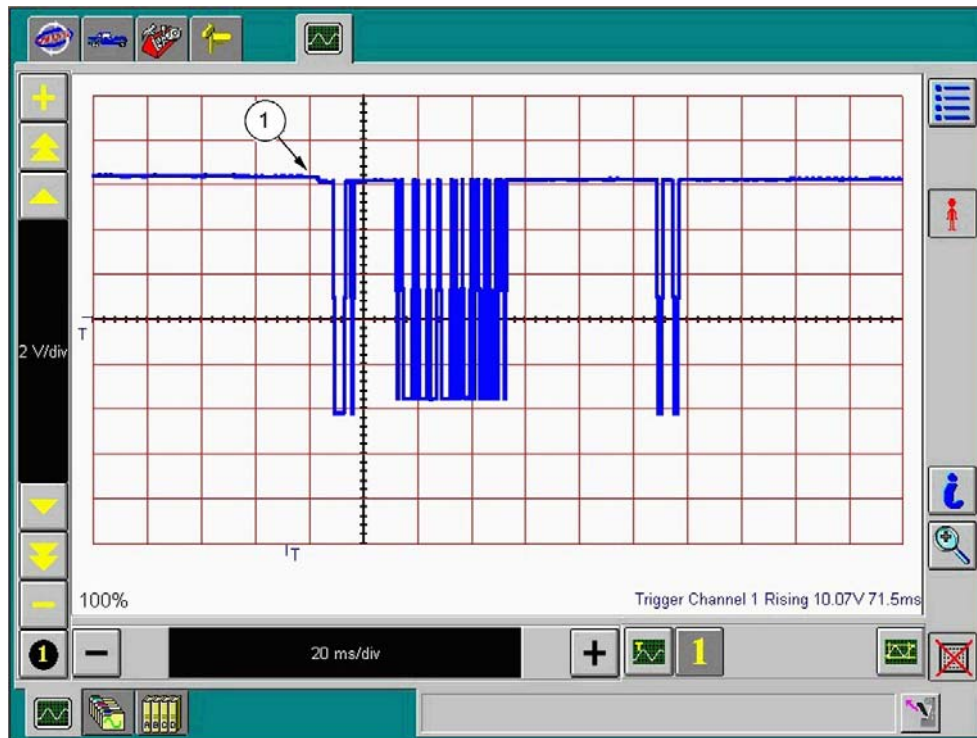
1007_S003

1 Signal start

2 No transponder signal

Communication Signal between Immobilizer Module and PCM

- Good signal measured at terminal “A” of the immobilizer module during the key ID-number verification process.



1007_S005

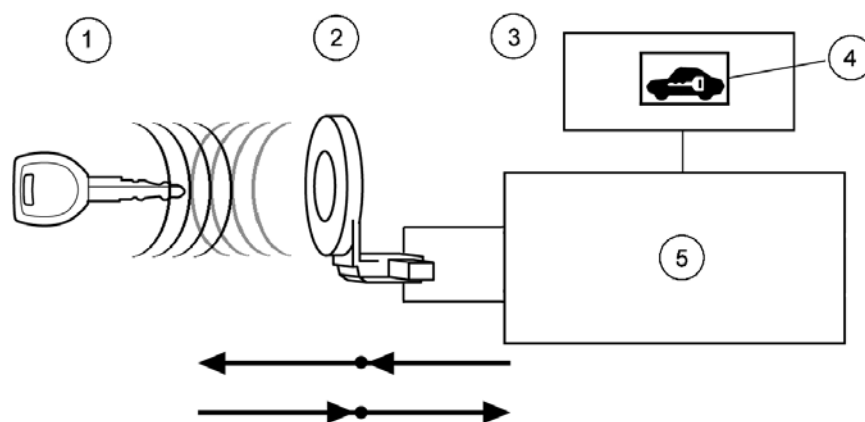
1 12 V

PATS

Design and Operation

Integrated PATS

- The system consists of transponder key, coil antenna, PCM and security light. The key contains a crypto transponder with automatically changing code.
- The key ID-numbers are stored in a non-volatile memory of the PCM. At each start the module compares the ID-number of the key used with those it has stored.
- The PCM activates starter, ignition and fuel injection if the verification of the ID-number has been successful.



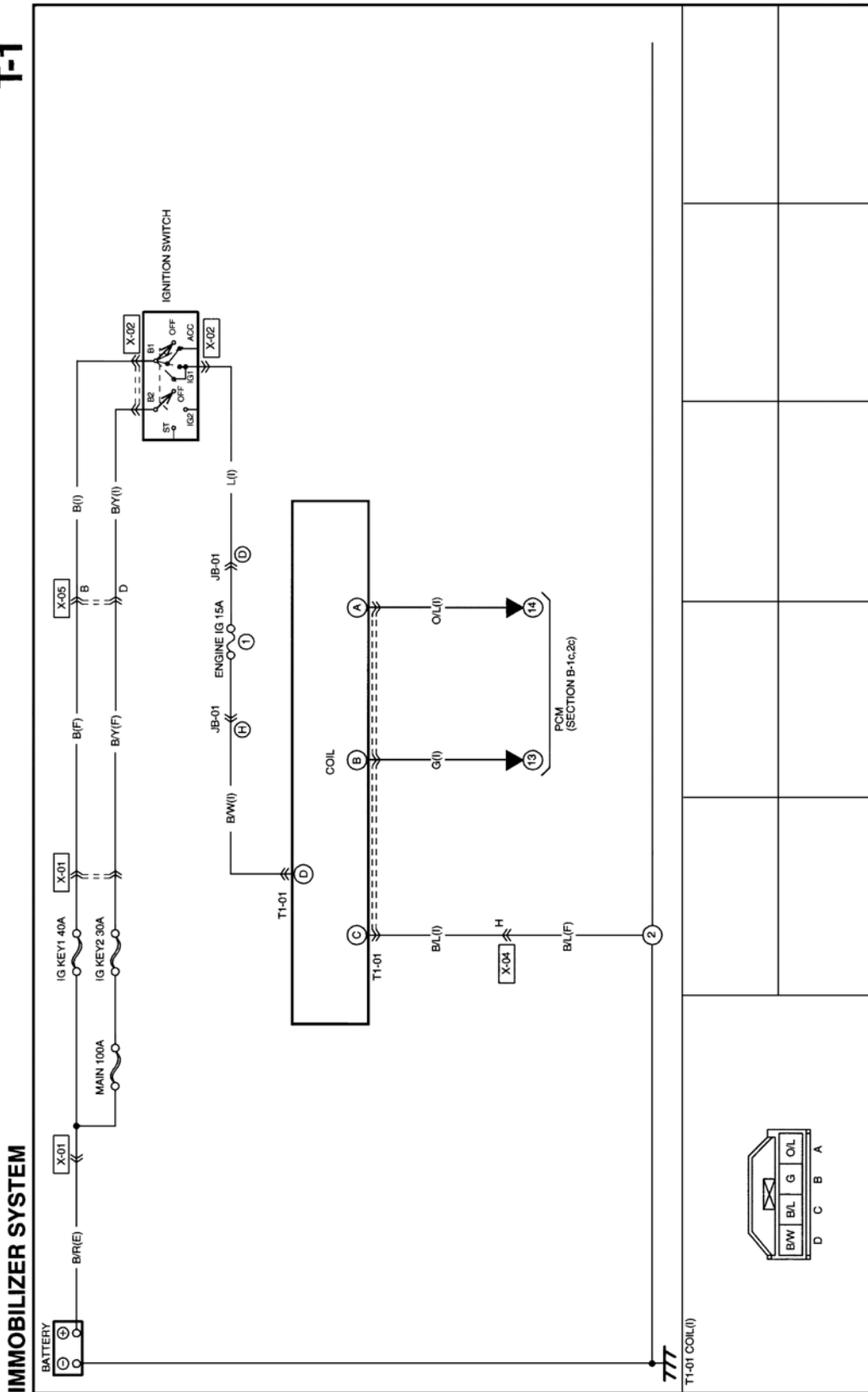
1007_019d

I-PATS components

- | | | | |
|---|--------------------|---|----------------|
| 1 | Key (transponder) | 4 | Security light |
| 2 | Coil antenna | 5 | PCM |
| 3 | Instrument cluster | | |

NOTE: The I-PATS of the Tribute is equipped with an Anti-scan function. After the use of an invalid key the next starting attempt with a valid key is prevented for 20 s.

T-1

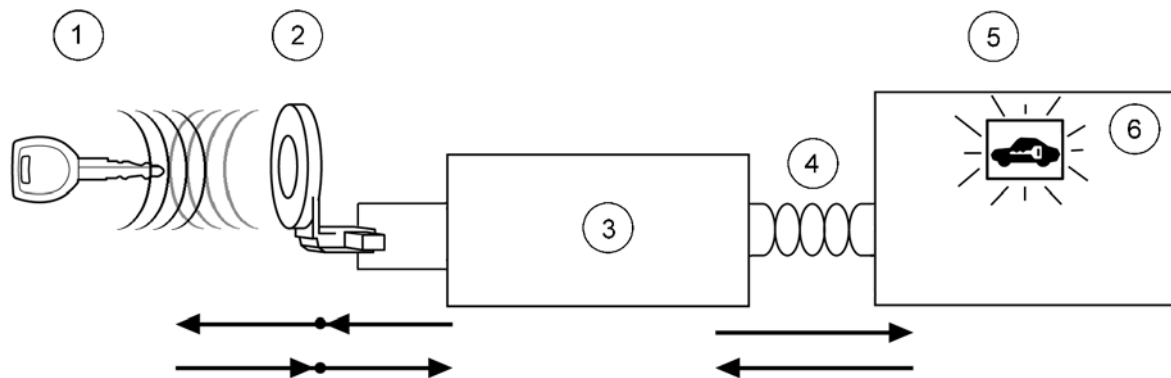


Wiring diagram of I-PATS coil antenna [Mazda6 (GG)]

1007_018

Distributed PATS

- The PATS functionality is incorporated in the control module and has been distributed to 2 components to increase anti-theft protection. As a result, an additional component, which cannot be removed easily, is required to enable engine start.
- After completion of the usual PATS communication between transponder, coil antenna and PCM, the control module also requests a code from the additional module via the HS - CAN bus.
- All of the code requests must be completed successfully before the control module will send an enable signal for the engine start to the PCM.
- The D-PATS consists of transponder key, coil antenna, IC or RKE, PCM and security light. The key contains a crypto transponder with automatically changing code.
- Currently Mazda uses three variants of D-PATS:
 - The D-PATS of the Mazda2 (DY) uses the PCM to control the immobilizer functions and the IC as additional component to verify the validation code.

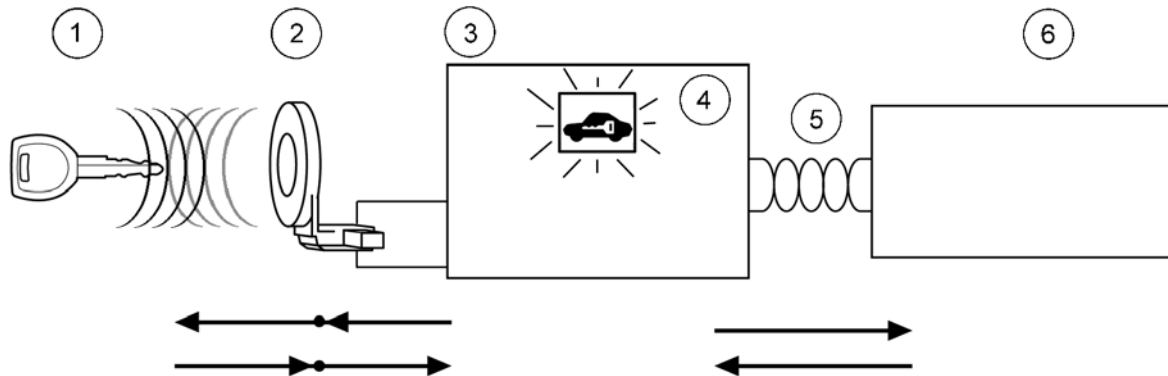


1007_019b

D-PATS components (Mazda2)

- | | | | |
|---|-----------------|---|--------------------------|
| 1 | Transponder key | 4 | HS-Can bus |
| 2 | Coil antenna | 5 | Instrument cluster (HEC) |
| 3 | PCM | 6 | Security light |

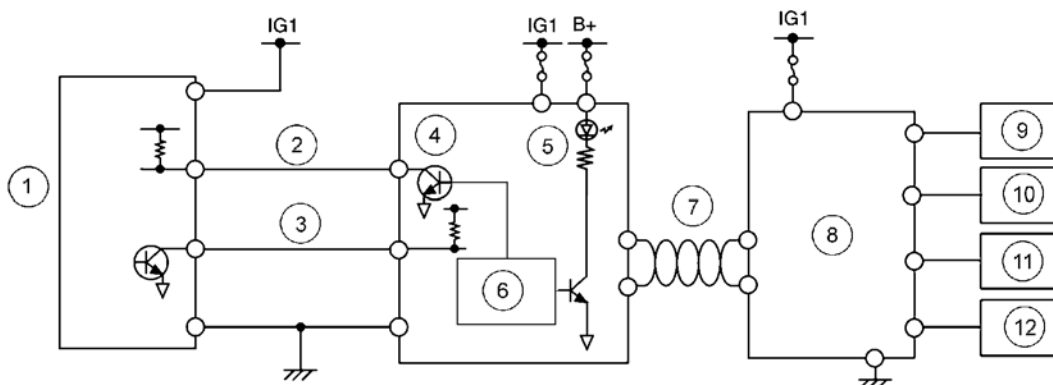
- The D-PATS of the Mazda3 (BK) uses the IC to control the immobilizer functions and the PCM as additional component to verify the validation code.



1007_019a

D-PATS components (Mazda3)

- | | | | |
|---|--------------------|---|----------------|
| 1 | Transponder key | 4 | Security light |
| 2 | Coil antenna | 5 | HS-Can bus |
| 3 | Instrument cluster | 6 | PCM |



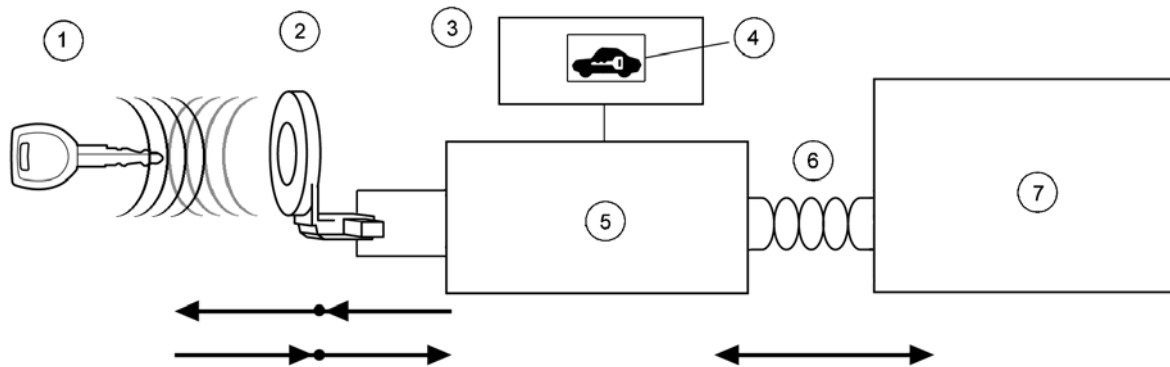
1007_020

D-PATS circuit diagram (Mazda3)

- | | | | |
|---|--------------------|----|-----------------|
| 1 | Coil antenna | 7 | HS-CAN bus |
| 2 | Tx-line | 8 | PCM |
| 3 | Rx-line | 9 | Fuel injector |
| 4 | Instrument cluster | 10 | Fuel pump relay |
| 5 | Security light | 11 | Ignition coil |
| 6 | Microprocessor | 12 | Starter relay |

NOTE: On the Mazda2 and the Mazda3 the IC is sometimes also termed as HEC.

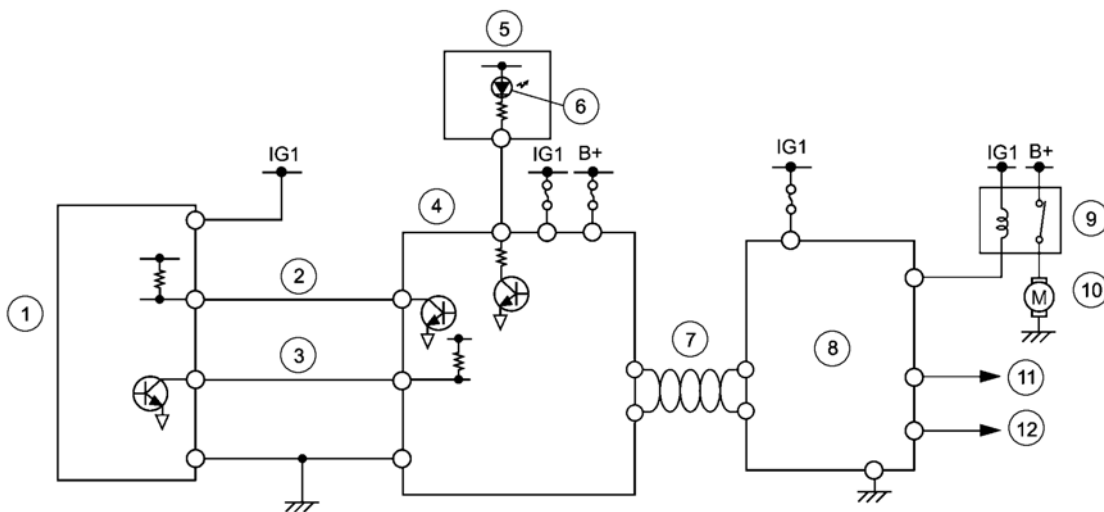
- The D-PATS of the RX-8 (SE) uses the RKE module to control the immobilizer functions and the PCM as additional component to verify the validation code.



1007_019c

D-PATS components (RX-8)

- | | | | |
|---|--------------------|---|------------|
| 1 | Transponder key | 5 | RKE module |
| 2 | Coil antenna | 6 | HS-Can bus |
| 3 | Instrument cluster | 7 | PCM |
| 4 | Security light | | |



1007_020b

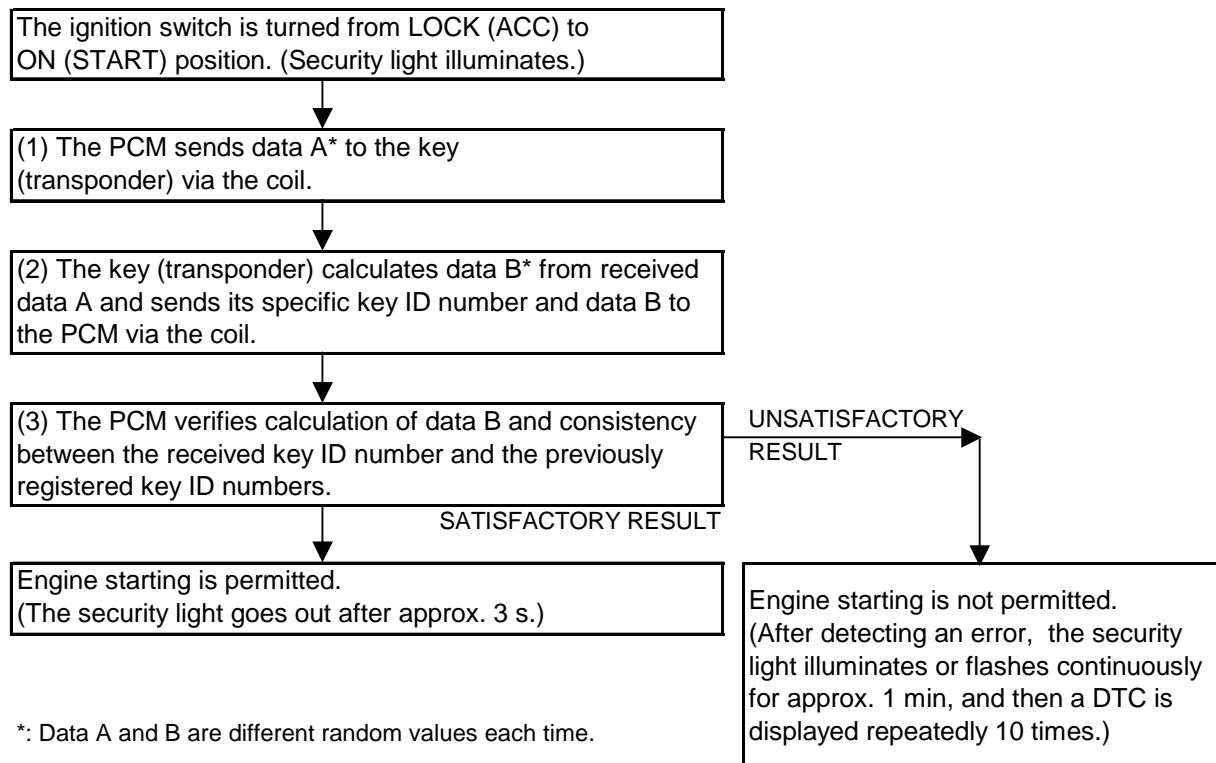
D-PATS circuit diagram (RX-8)

- | | | | |
|---|--------------------|----|---------------|
| 1 | Coil antenna | 7 | HS-CAN bus |
| 2 | Tx-line | 8 | PCM |
| 3 | Rx-line | 9 | Starter relay |
| 4 | RKE | 10 | Starter motor |
| 5 | Instrument cluster | 11 | Ignition coil |
| 6 | Security light | 12 | Fuel injector |

Key ID-Number Verification Process

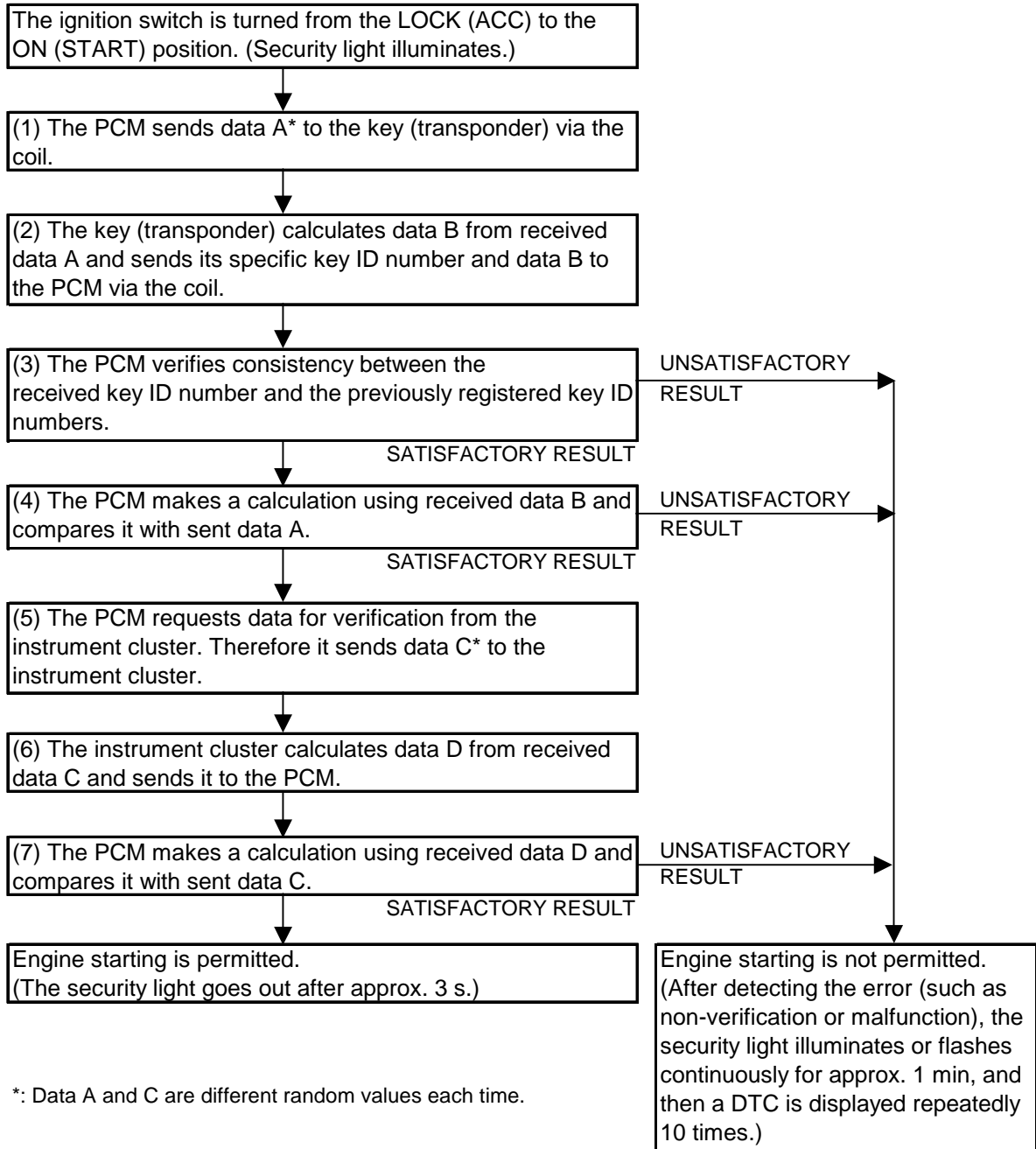
- The following flowcharts show the verification process of the ID-number on the various PATS.

I-PATS



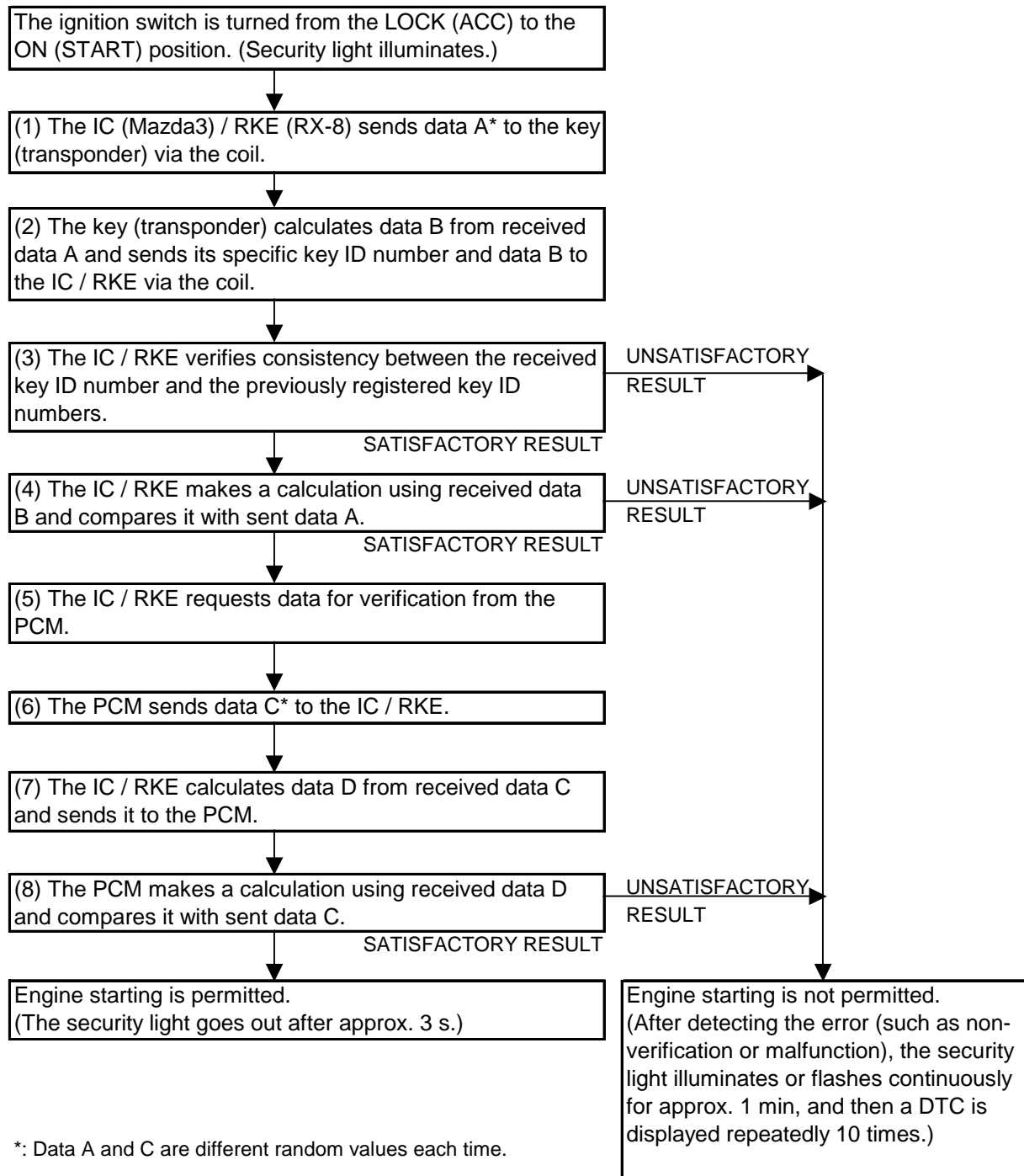
1007_T005

D-PATS (Mazda2)



1007_T007

D-PATS (Mazda3 and RX-8)



1007_T006

PATS Service Functions

- While replacing PATS components follow the detailed procedures as described in the respective W/M.
- The customer should bring all keys to the dealer. This is important because it may be necessary to program all key ID-numbers during the replacement of PATS components.
- The security access procedure with the WDS is utilized to obtain PATS security access in order to program additional ignition key(s), to erase ignition keys, to enable/disable spare key programming or to perform a parameter reset.
- If the engine is started during the key registration procedure, the key registration mode will be aborted. Therefore, do not start the engine until the key registration procedure for all the necessary keys is finished.
- When you replace the PCM and the IC / RKE of the D-PATS at the same time, follow the W/M instruction for "Instrument cluster" / "Remote Keyless Entry" (Mazda3 and RX-8).

I-PATS Service Functions Table

Item	Procedure
Key addition	The key ID-number of the key to be added must be registered in the PCM. Key ID number registration can be performed according to the following methods: <ul style="list-style-type: none"> • Using two already registered keys ("Customer Spare Key Programming" must be enabled). • Using WDS: Security access > "Additional Key Programming".
Key deletion / replacement	Registered key ID-numbers can be deleted from the PCM using the following methods: <ul style="list-style-type: none"> • Using two already registered keys ("Customer Spare Key Programming" must be enabled). All key ID-numbers are cleared except those of the two keys used. • Using WDS: Security Access > "Ignition Key Code Erase". All key ID-numbers are cleared. Two keys have to be registered to start the engine.
PCM replacement	Key ID-numbers for all keys that were being used must be registered in the new PCM. <ul style="list-style-type: none"> • New PCM - Two keys have to be registered to start the engine. • Used PCM - Using WDS: Security Access > "Ignition Key Code Erase". Two keys have to be registered to start the engine.

1007_T008

D-PATS Service Functions Table (Mazda2)

Item	Procedure
Key addition	<p>The key ID-number of the key to be added must be registered in the PCM. Key ID number registration can be performed according to the following methods:</p> <ul style="list-style-type: none"> • Using two already registered keys ("Customer Spare Key Programming" must be enabled). • Using WDS: Security access > "Additional Key Programming".
Key deletion / replacement	<p>Registered key ID-numbers can be deleted from the PCM using the following methods:</p> <ul style="list-style-type: none"> • Using two already registered keys ("Customer Spare Key Programming" must be enabled). All key ID-numbers are cleared except those of the two keys used. • Using WDS: Security Access > "Ignition Key Code Erase". All key ID numbers are cleared. Two keys have to be registered to start the engine.
PCM replacement	<p>Key ID numbers for all keys being used must be re-registered. Two or more keys have to be registered to start the engine.</p> <ul style="list-style-type: none"> •Using WDS: Security Access > "Parameter Reset" and "Ignition Key Code Erase" must be performed. •All keys should be available
Instrument cluster replacement	<p>Key ID numbers for all keys being used need <u>not</u> to be re-registered. They are stored in the PCM and are automatically transmitted to the new IC.</p> <ul style="list-style-type: none"> • Security Access > "Parameter Reset" must be performed with WDS.

1007_T009

D-PATS Service Functions Table (Mazda3 / RX-8)

Item	Procedure
Key addition	Key ID number of the key to be added must be registered in the IC or RKE. Key ID number registration can be performed according to the following methods: <ul style="list-style-type: none"> • Using two already registered keys ("Customer Spare Key Programming" must be enabled). • Using WDS: Security access > "Additional Key Programming"
Key deletion / replacement	All key ID numbers are cleared. Two keys have to be registered to start the engine. <ul style="list-style-type: none"> • Using WDS: Security Access > "Ignition Key Code Erase" must be performed.
PCM replacement	The key ID numbers of all keys being used need <u>not</u> to be re-registered. They are stored in the IC or RKE and automatically transmitted to the new PCM. <ul style="list-style-type: none"> • Using WDS: Security access > "Parameter Reset" must be performed.
IC or RKE replacement	The key ID numbers of all keys being used must be re-registered. Two keys must be registered at least to enable engine start. <ul style="list-style-type: none"> • Using WDS: Security access > "Parameter Reset" and "Ignition Key Code Erase" must be performed. • All keys should be available.

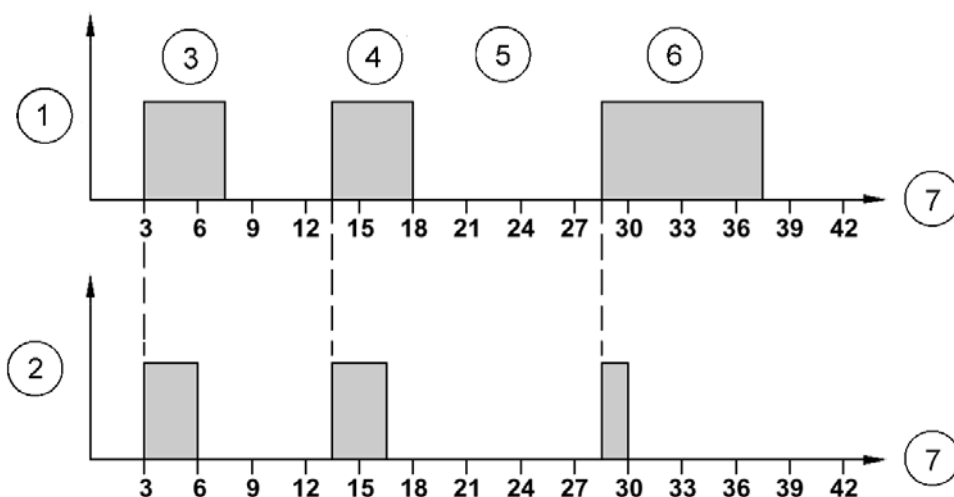
1007_T010

Key Programming without WDS

- On all PATS additional keys can be programmed with two or more valid keys according to the following procedure:
 1. Insert the first valid key in the ignition switch and turn it to the ON position for 3 s.
 2. Insert the second valid key within 5 s in the ignition switch and turn it to the ON position for 3 s.
 3. Insert the new key in the ignition switch within 20 s and turn it to the ON position for 3 s.
 4. Program all further keys according to step 3. Then start the vehicle with all keys to check for correct function.
 5. After successful key programming, clear DTCs stored in the PCM.

NOTE: The PATS function “Customer spare key programming” must be enabled for this procedure to operate.

NOTE: This programming procedure is content of the owner’s manual of the Mazda Tribute (EP) and can be performed by the vehicle owner.



1007_021

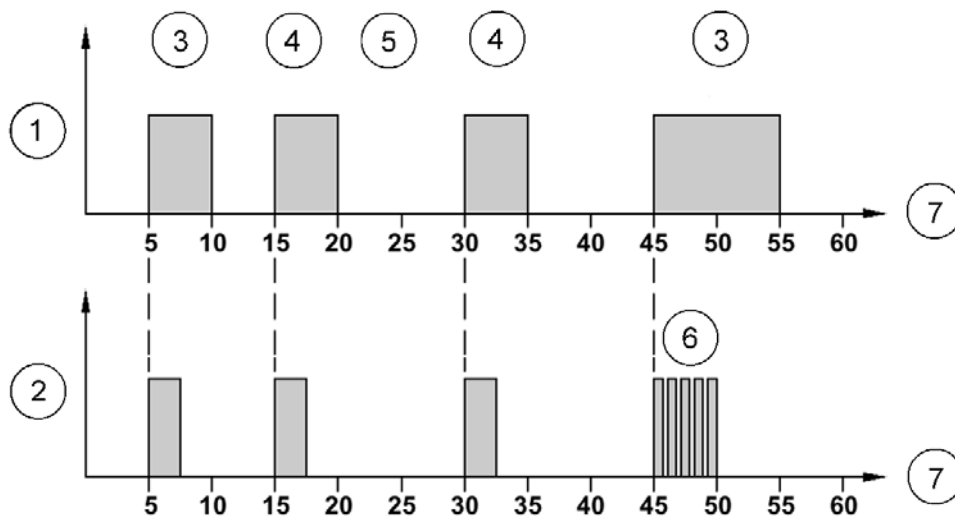
- | | | | |
|---|------------------------------|---|------------------------------|
| 1 | Ignition ON/OFF | 5 | Programming mode switched on |
| 2 | Security light flashing code | 6 | Programming |
| 3 | First valid key | 7 | Time in seconds |
| 4 | Second valid key | | |

Key Deletion without WDS

- This procedure is available for I-PATS and for the D-PATS of the Mazda2 (DY). It is helpful when a key has been lost or the number of valid keys is unknown, for example in the case of a used car. The procedure deletes all the keys except for the two valid keys that are used:
 1. Insert the first valid key in the ignition switch and turn it to the ON position for 3 s.
 2. Insert the second valid key within 5 s in the ignition switch and turn it to the ON position for 3 s.
 3. Turn the second valid key to the OFF position and turn it within 10 s back to the ON position for 3 s.
 4. Insert the first valid key within 10 s in the ignition switch and turn it to the ON position for 10 s. The security light flashes for 5 s to confirm the deleting procedure.
 5. After successful key programming, clear DTCs stored in the PCM.

NOTE: The PATS function “Customer spare key programming” must be enabled for this procedure to operate.

NOTE: If the valid key is turned to the OFF position while the PATS LED is flashing for 5 s, the deleting procedure is aborted.



1007_021

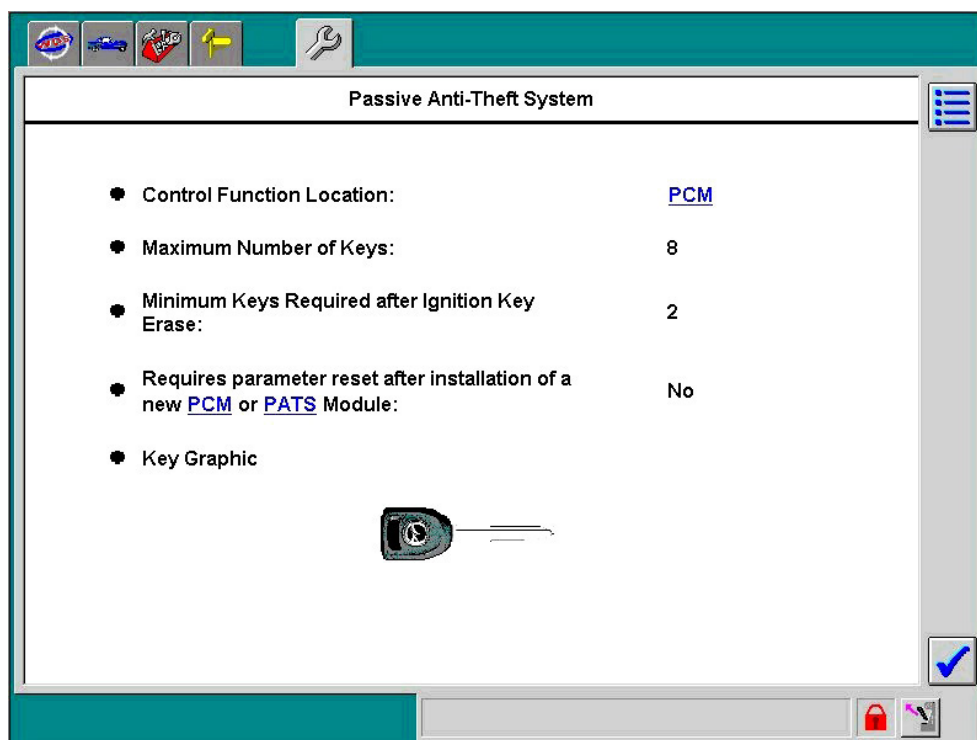
- | | | | |
|---|------------------------------|---|------------------------------|
| 1 | Ignition ON/OFF | 5 | Programming mode switched on |
| 2 | Security light flashing code | 6 | PATS memory deleted |
| 3 | First valid key | 7 | Time in seconds |
| 4 | Second valid key | | |

PATS Functions with WDS

Security Access

- The security access is a special access mode via WDS for conducting certain PATS service functions. The coded security access is designated to prevent any misuse. The following PATS functions are protected:
 - Programming additional keys
 - Deleting all the keys and registering new keys
 - Changing preset parameters for adding new keys using two registered keys
 - Parameter reset
 - Enabling / disabling the limitation in the number of programmable keys

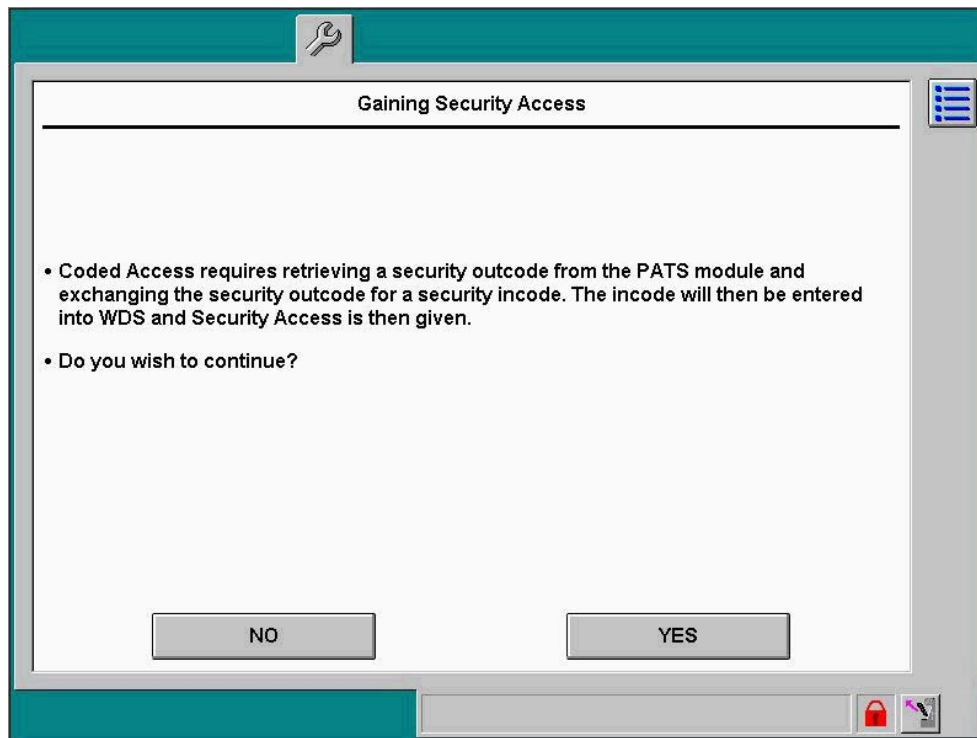
- To get access to the protected PATS function menu select: Toolbox→Body→Security→PATS Functions. If you press the tick button, the WDS will display the following information about PATS.



1007_S006

Start screen for I-PATS functions (Mazda6)

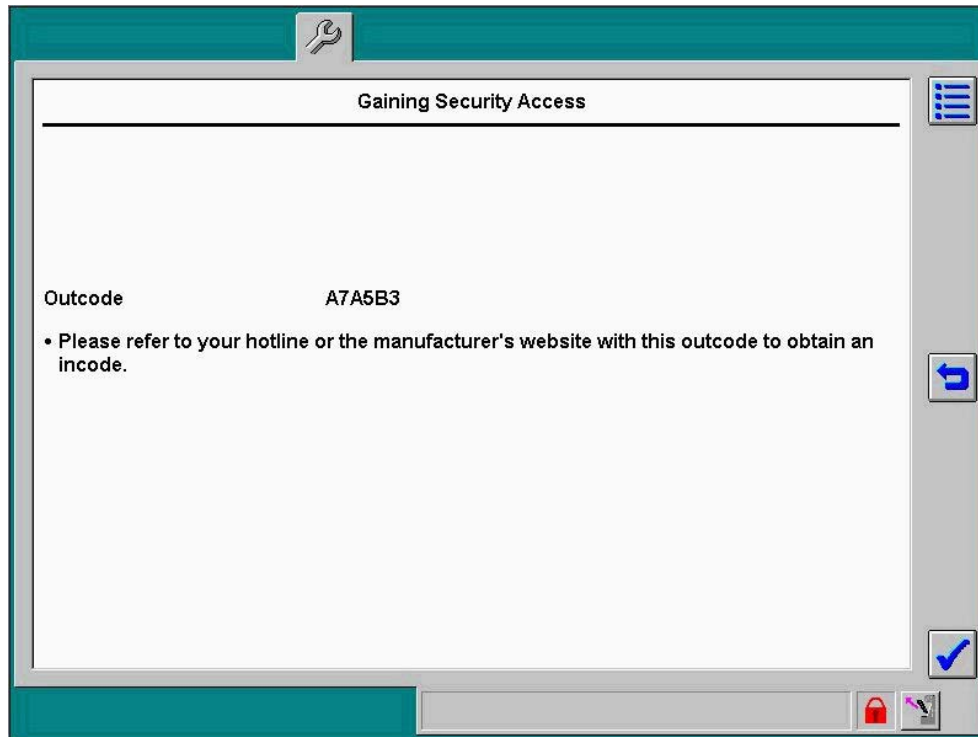
- After you have pressed the tick button again, WDS asks you to retrieve a security outcode from the PATS control module.



1007_S007

NOTE: The PATS function menu of the Mazda Tribute (EP) is accessible via a timed security access instead of the coded security access. Prior to granting security access the timed security access mode requires 10 minutes time delay instead of a code to be entered.

- If you press “Yes”, the WDS will display an outcode from the PATS control module.

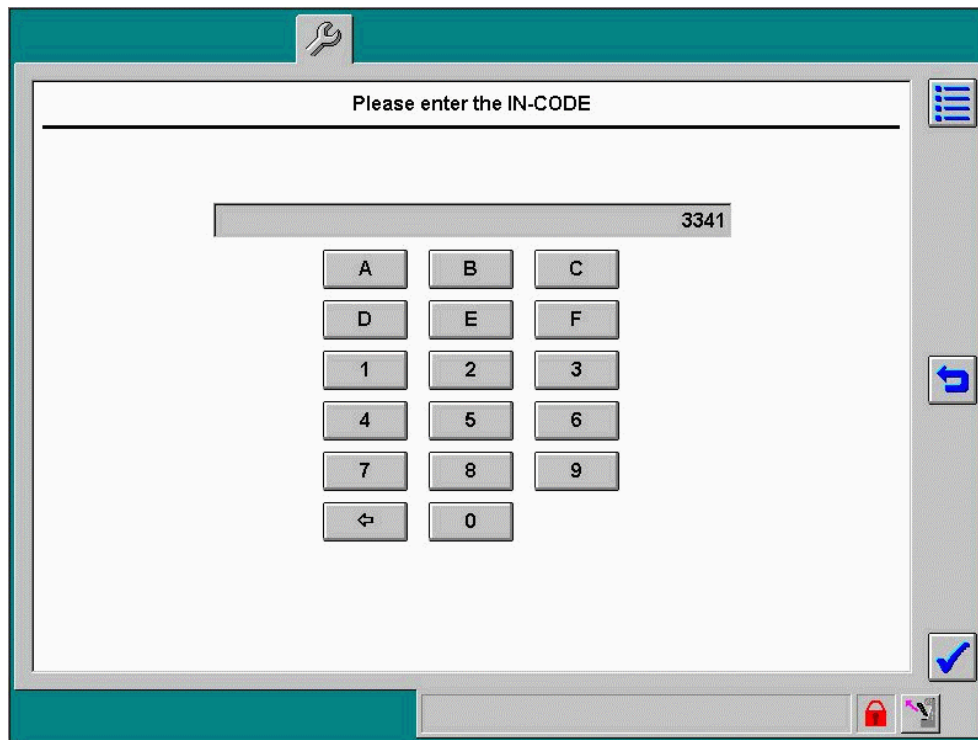


1007_S008

NOTE: When WDS displays the "outcode", do not turn the ignition switch from the LOCK position to the ON position more than 5 times and do not disconnect the battery cables. Otherwise a new outcode will be generated for security reasons. The outcode contains 6 digits and the incode 4 digits.

NOTE: The Mazda dealer can obtain the incode from the Technical Hotline / Technical Service Department with a prepared request form that must contain the outcode , VIN and other data.

- After you have pressed the tick button, the WDS displays a keyboard and instructs you to enter the incode.

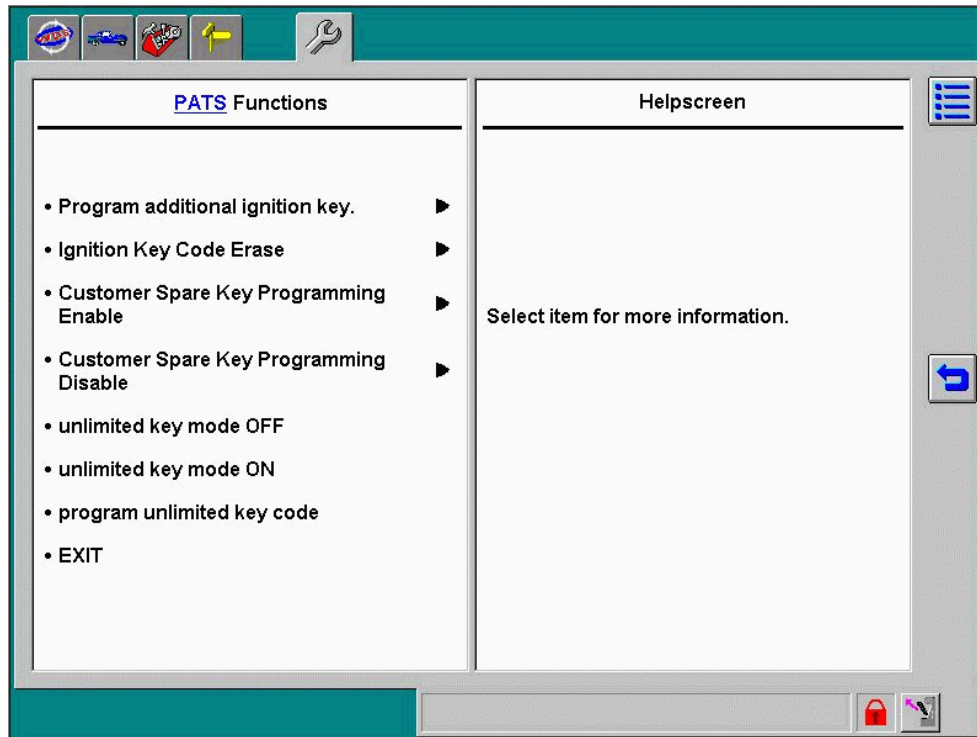


1007_S009

NOTE: The Ignition has to be switched to the ON position while the incode is entered.

PATS Functions Menu

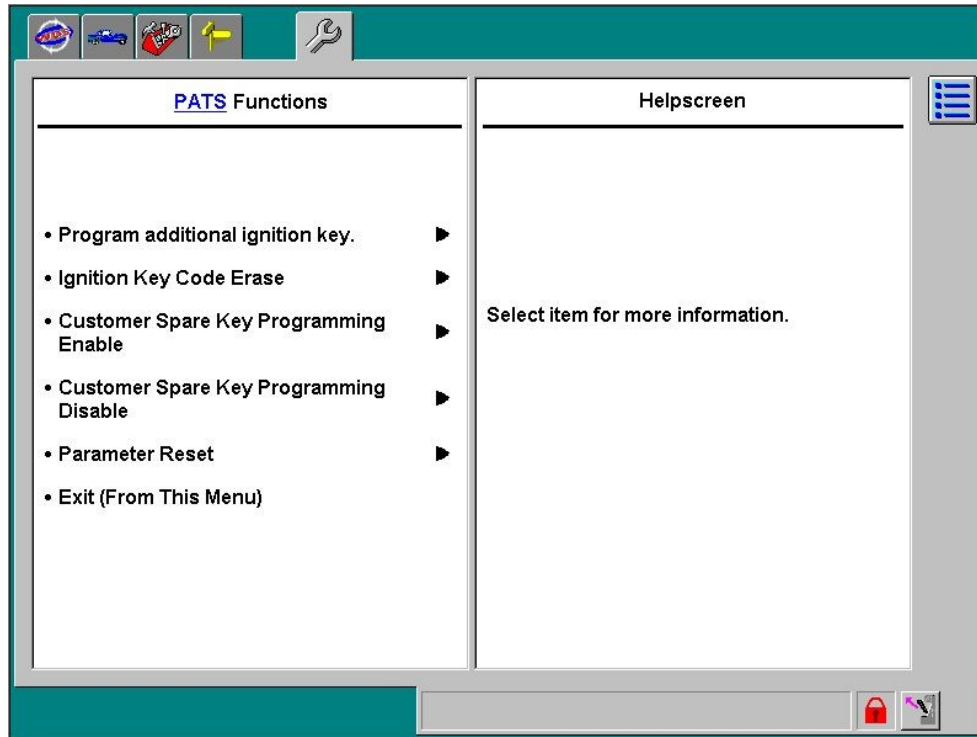
- After the WDS has granted security access the following screen appears displaying the PATS functions menu (here for the I-PATS of the Mazda6).



1007_S010

NOTE: When the security access is granted do not turn off WDS, do not disconnect the data link connector (DLC), do not start the engine or turn the ignition switch to the OFF position and leave for more than 10 seconds, as this will exit the security access mode.

- The PATS functions menu of the D-PATS looks slightly different. The items “Unlimited Key Mode ON”, “Unlimited Key Mode OFF” and “Program Unlimited Key Code” have been removed (not for Mazda2) and the item “Parameter Reset” has been added.



1007_S011

Items of the PATS Functions Menu

- **Program additional ignition key**
 - Programs one or more additional ignition key(s) without erasing registered keys. The procedure does not require the use of a registered key.
- **Ignition Key Code Erase**
 - Deletes all registered key ID-numbers. Requires to register 2 keys before the engine will start.
- **Customer Spare Key Programming Enable**
 - Permits the use of additional key programming without WDS using two registered keys.
- **Customer Spare Key Programming Disable**
 - Prohibits the use of additional key programming without WDS using two registered keys. This is useful for fled or hired vehicles.
- **Parameter Reset**
 - Must be performed on vehicle with D-PATS when the PCM, IC or RKE have been replaced. Requires a second security access procedure.
- **Unlimited key mode ON**
 - Disables the limitation to 8 programmable keys.
- **Unlimited key mode OFF**
 - Enables the limitation to 8 programmable keys.
- **Program unlimited key code**
 - Initializes access to the unlimited key mode functions.

NOTE: When you have selected the desired option follow the instructions of the WDS.

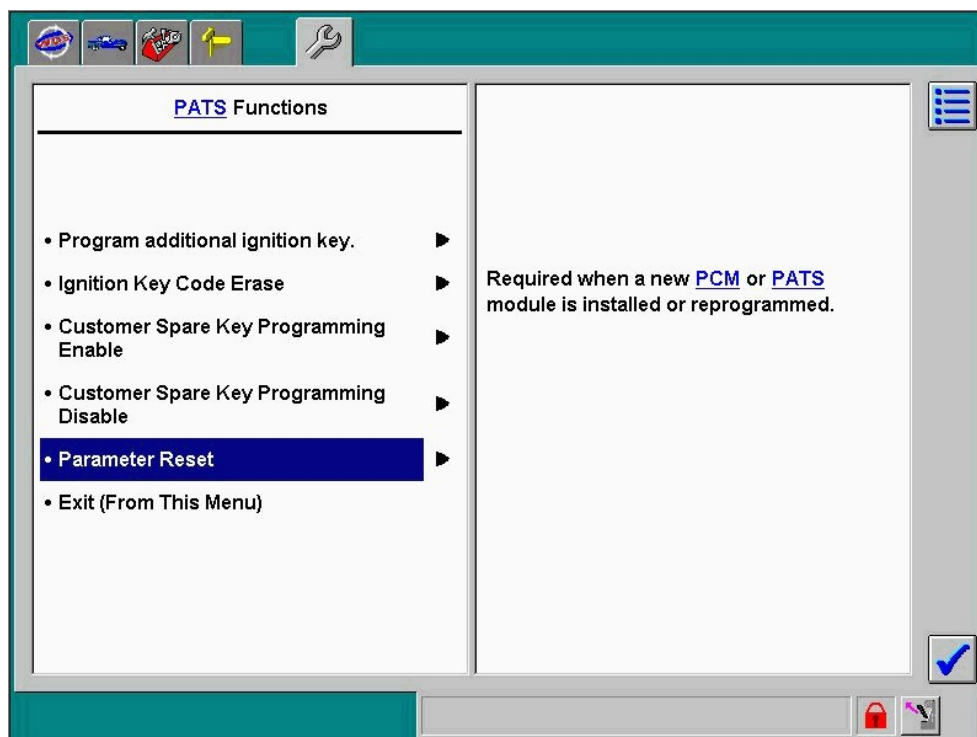
NOTE: After selecting a function from the menu (except for “Program additional ignition key” and “Customer Spare Key Programming Enable / Disable”) or after the menu is quitted the security access procedure must be repeated again to choose additional options.

Parameter Reset

- After the D-PATS control module has been replaced the function “Parameter reset” must be performed. It synchronizes the control and the additional module to enable the data transfer between them during the ID-number verification process.

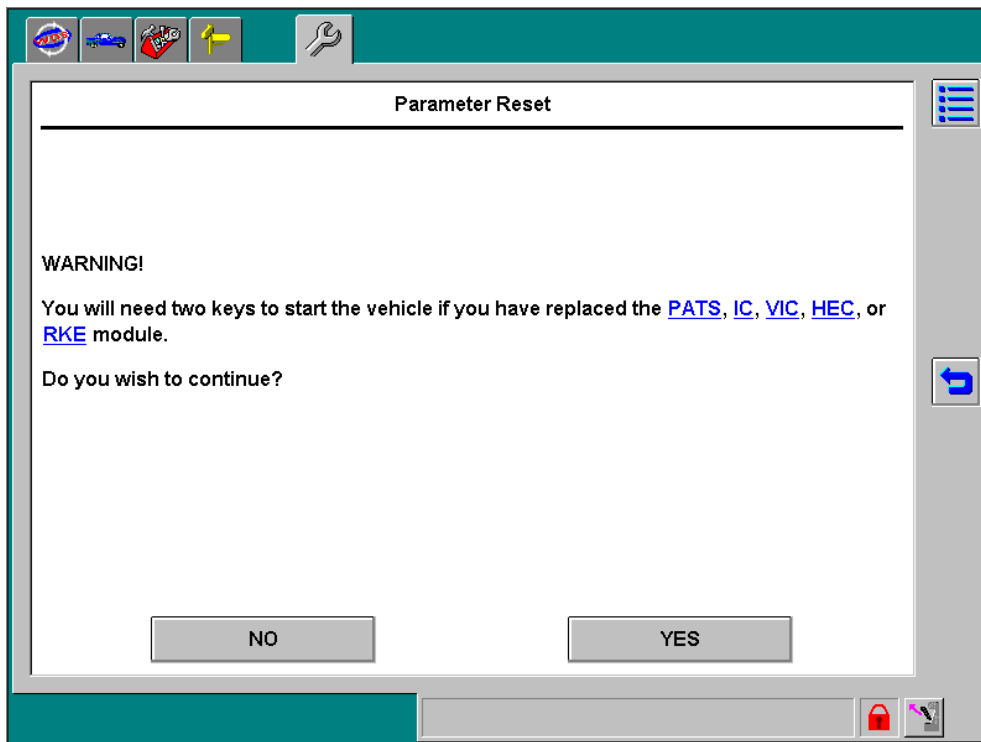
Parameter Reset Procedure

- Perform the Parameter reset according to the following procedure as shown in the example for the IC of the Mazda3.
- After you have selected “Parameter Reset” and pressed the tick button the security access is requested again, i.e. a second incode is required.

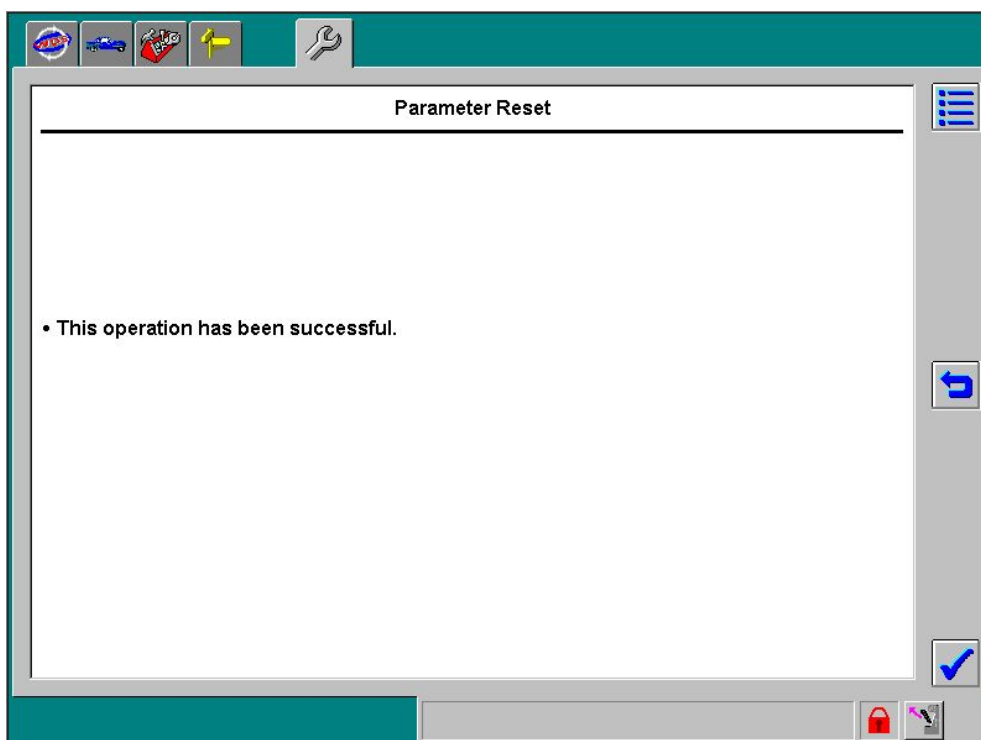


1007_S012

- Follow the instructions of the WDS.

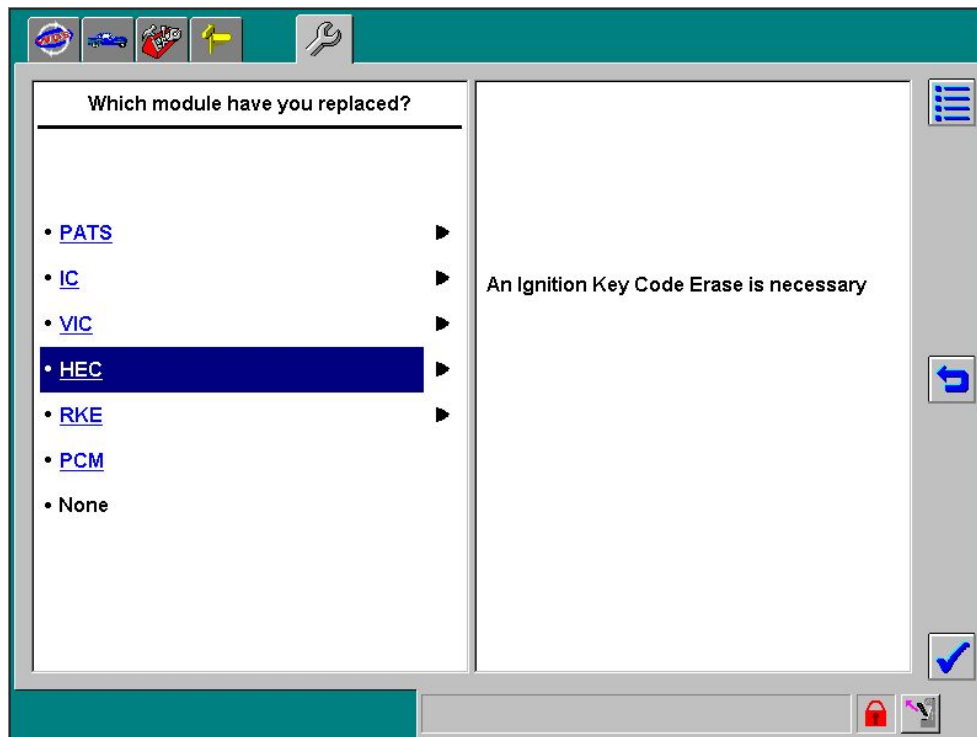


1007_S013



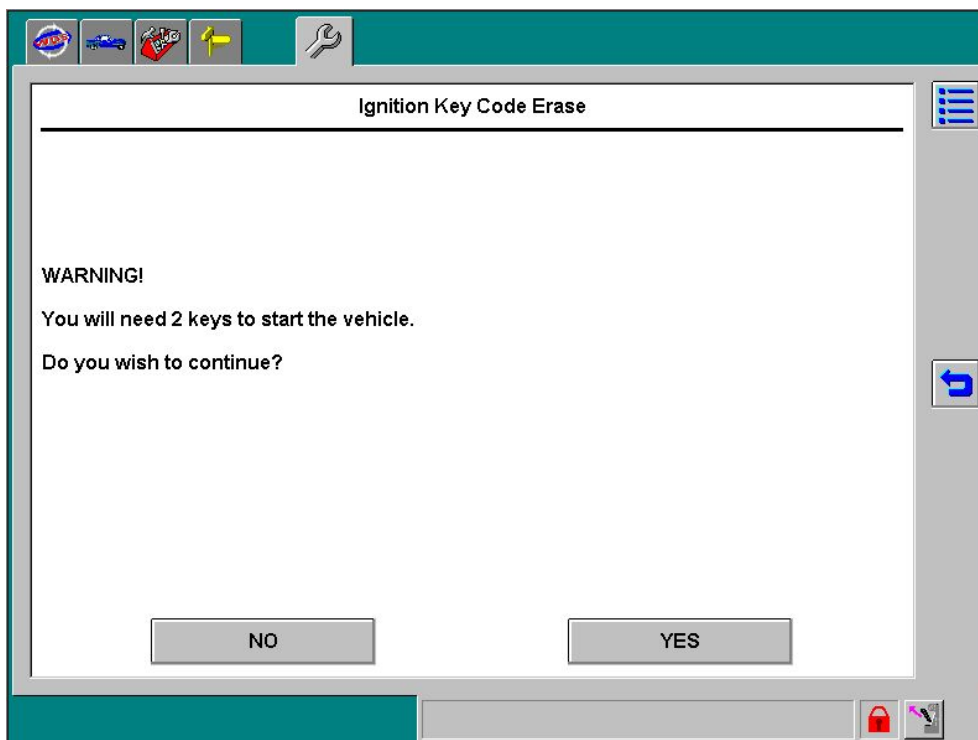
1007_S014

- The following screen displays all replaceable modules, which are involved in the PATS of several vehicle types of Ford and Mazda. Select HEC module and press the tick button. "Ignition key code erase" is the next step.



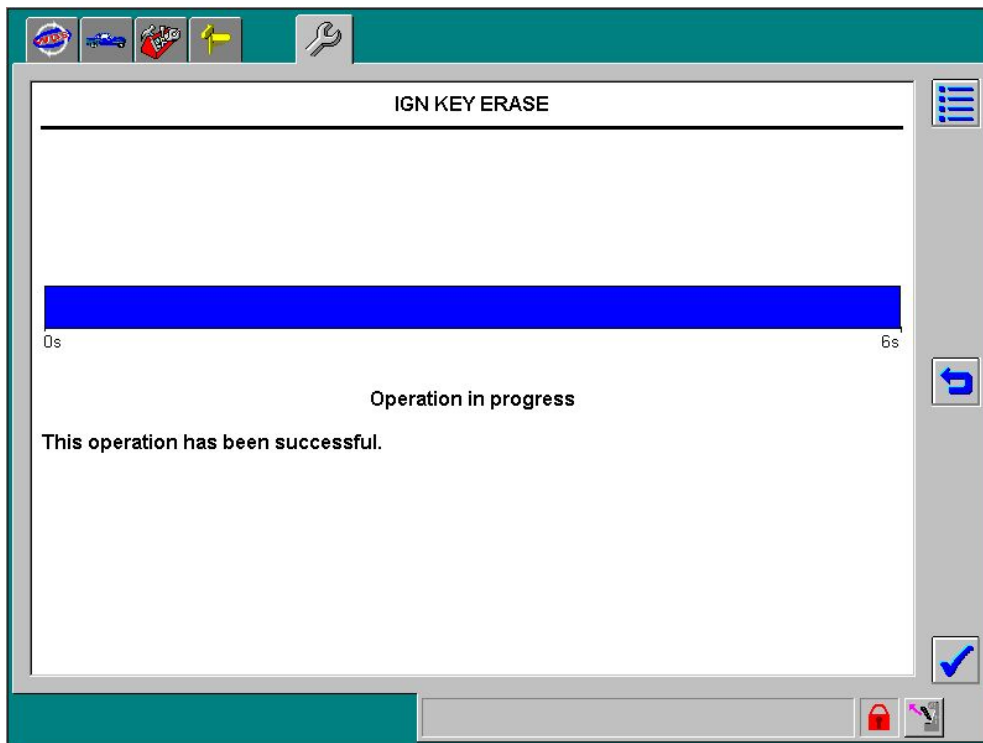
1007_S015

NOTE: When the IC has been replaced on Mazda2 and Mazda3 the menu item "HEC" must be selected. The items PATS, IC and VIC in this menu are without function.



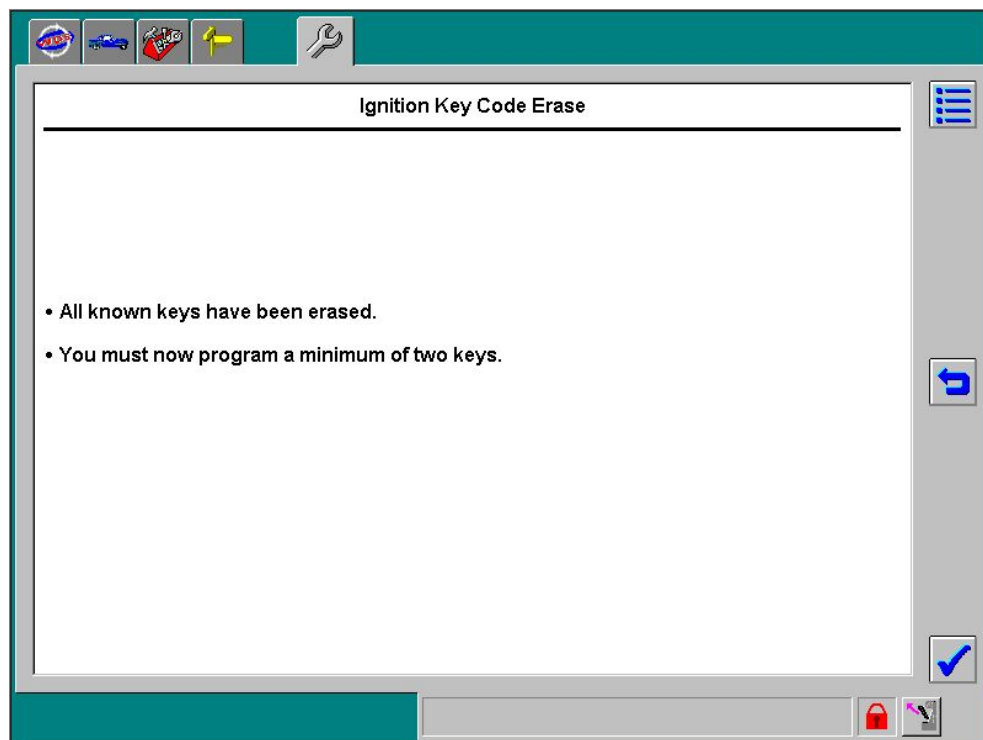
1007_S016

- Press the tick button.



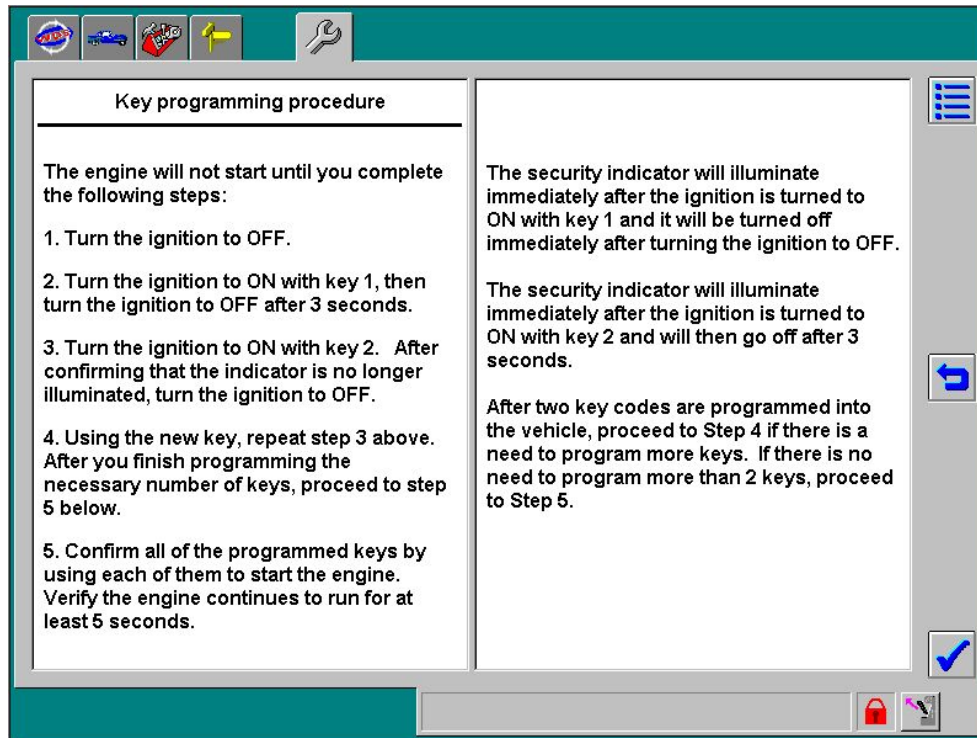
1007_S017

- In this screen it is confirmed that all key ID-numbers have been deleted. Afterwards two keys must be programmed. Press the tick button.



1007_S018

- The final screen gives instructions for the required key programming. The procedure is identical to the procedure “Key programming without WDS” as described above.

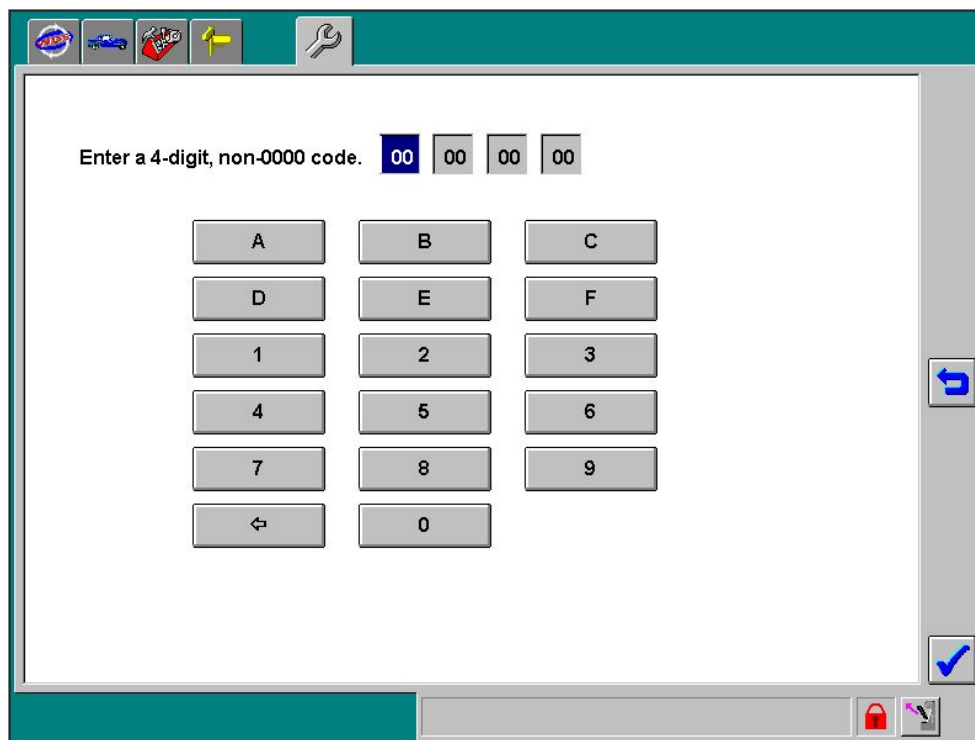


1007_S019

NOTE: It is not relevant for the subsequent key programming whether WDS is still connected to the DLC or not.

Unlimited Key Mode

- The unlimited key mode function is available for Mazda2 (DY), Mazda6 (GG / GY). It permits programming of more than 8 keys for fleet or hire vehicles. To enable this function, select the option “Program unlimited key code” from the PATS functions menu. After you have pressed the tick button, the WDS displays a keyboard to enter a key code. You can input any value except for “00 00 00 00”.



1007_S020

- If you press the tick button again, the WDS programs the key code into the PCM. Then select the option “Unlimited key mode ON” from the PATS functions menu.
- After two keys have been newly registered (see note below), the PCM permits the programming of more than 8 keys according to the procedure “Key Programming without WDS”. To disable this feature, select the option “Unlimited key mode OFF”. Then the PCM prohibits the programming of more than 8 keys.

NOTE: The unlimited key mode function should not be used unintentionally, because it locks all registered keys and the engine start is disabled. Once this function has been used, two keys at minimum must be newly registered via the function “Ignition key code erase”, which requires to repeat the security access procedure.

Diagnosis

On-Board Diagnostic System

- The **On-Board Diagnostic (OBD)** system of PATS is incorporated in the PATS control module. It comprises a malfunction detection function and diagnosis function that start operating automatically when the ignition switch is turned to the ON position.
- The OBD system monitors the function of the different components and the signal transfer between them. A detected malfunction is indicated as appropriate DTC.
- There are two methods of DTC verification: By the security light that outputs a DTC as a corresponding flashing pattern and by reading out the DTC memory of the relevant modules using the WDS.
- Detected DTCs of the PATS are cleared when the ignition switch is turned from the ON to the OFF (ACC) position. Consequently malfunctions are only indicated when they are present.
- The OBD function **PID (Parameter IDentification)** data monitoring allows to display the status of system parameters with the aid of e.g. WDS. Depending on the PATS various PIDs are available (refer to the respective W/M). However, the following PID is available on all PATS:
 - “NUMKEYS” (number of registered keys)


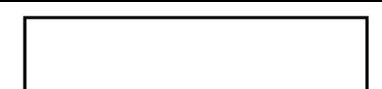
NOTE: Troubleshooting should always start with the inspection of the security light **and** the DTC memory of PATS with WDS. However, it is possible that the security light may not properly display a DTC if it has a malfunction itself. Therefore, use the WDS for the troubleshooting on PATS malfunctions in any case.

NOTE: If the immobilizer system has an intermittent malfunction, inspect the respective wiring pins for tight seat / good contact and the wiring for any open or short circuit. Refer also to W/M section “General Information→Electrical Systems” and “Engine”→”Symptom Troubleshooting”→”Intermittent Concern Troubleshooting”.

NOTE: When the engine does not start or starts but stalls afterwards, and no DTC is indicated neither by the security light nor by the WDS, the malfunction is most likely not related to the immobilizer system. In this case you will find supporting information in the W/M section “Fuel and Emission Control System”→“Engine Symptom Troubleshooting”, on the ESI CD: “Engine”→”Symptom Troubleshooting”. Information for the Mazda2 can be found on the service manual CD in section 303-14 (Electronic Engine Controls).

Security Light

- The security light of the PATS is controlled as follows:
 1. Immobilizer system activation is displayed by the security light, which flashes repeatedly for 0.1 s every 2 s.
 2. The immobilizer function is de-activated when the security light turns off 3 s after the ignition switch has been turned to the ON or START position.
 3. If the immobilizer system is not de-activated (malfunction detected by the OBD function), the security light flashes or illuminates for 1 min depending on the malfunction:
 - The light *flashes* when DTC 16 or lower is detected.
 - The light *illuminates* when DTC 21 and higher is detected.

No.	Security light flashing pattern (Before displaying DTC)	DTC
1	ILLUMINATED  GOES OUT	11, 12, 13, 14, 15, 16
2	ILLUMINATED  GOES OUT	21, 22, 23

1007_T011

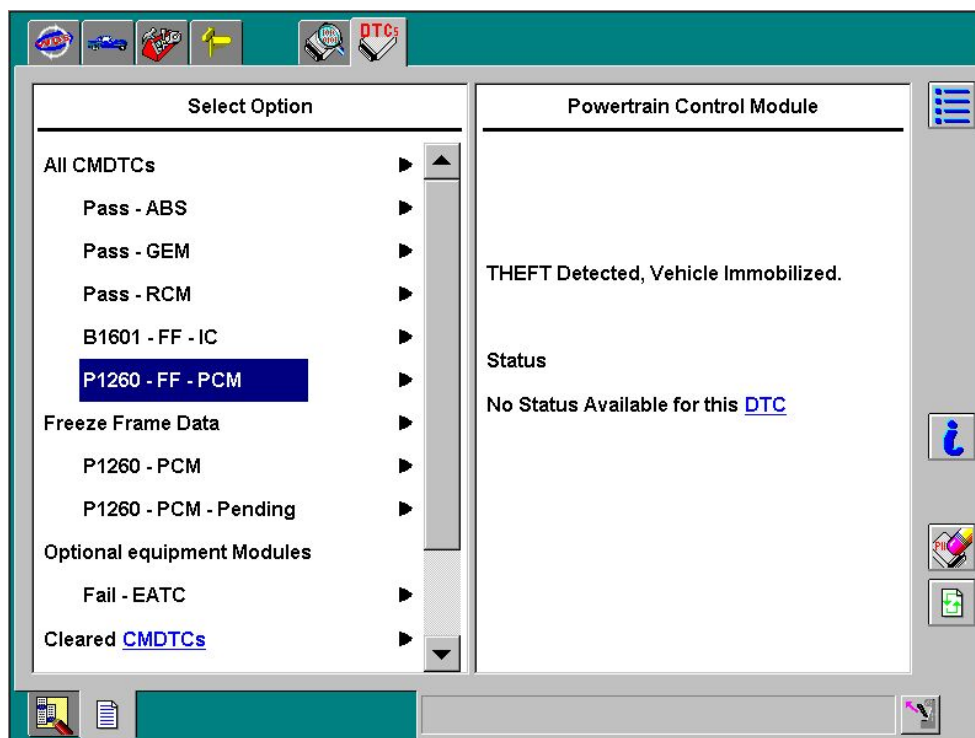
4. After the detection period the security light flashes the corresponding DTC for approximately 1 minute before it goes out. Each time the ignition switch is turned to the ON position the malfunction detection and indication process is repeated.

NOTE: The security light of each model equipped with PATS except for Mazda3 and RX-8 indicates a detected malfunction using only flashing pattern no.1.

NOTE: The immobilizer control module can store multiple DTCs at the same time. In this case only the present DTC with the lowest number of those detected will be displayed by the security light.

Diagnostic Trouble Codes

- On I-PATS the PCM detects a malfunction of the immobilizer system and stores a corresponding DTC. They are displayed as five digit DTCs by the WDS and as two digit codes by the security light.
- PATS malfunctions of the Mazda2 are stored in the PCM and in the IC. They can be retrieved as five digit DTCs from the PCM using WDS. Present malfunctions are additionally displayed for a certain time as two digit codes by the security light. The DTCs stored in the IC relate to communication failure between IC and PCM.
- PATS malfunctions of the Mazda3 / RX-8 are also stored as five digit DTCs in the IC / RKE and the PCM. When the PCM has disabled the engine start according to a malfunction detected by the IC / RKE, the corresponding DTC can be retrieved from the IC / RKE. In this case DTC P1260 (Theft detected, Vehicle immobilized) is always logged in the PCM.






NOTE: Refer to the W/M for further information.

1007_S021

DTC Table

- The DTC tables of the different PATS variants basically contain the same DTCs. They also provide a link for troubleshooting procedures appropriate to the DTCs.

DTC		WDS display*		Detection condition	Page (hyperlinked)
Security light flashing pattern	RKE	PCM			
			11		B1681
12		B2103	P1260	Coil malfunction	SECURITY LIGHT: 12, DTC B2103/P1260
13		B1600	P1260	The key ID number data cannot be read.	SECURITY LIGHT: 13, DTC B1600/P1260
		B2431	P1260	Key ID number registration error	SECURITY LIGHT: 13, DTC B2431/P1260

* : The letters at the beginning of each DTC are only displayed when using the WDS and refer to the following: B= Body system, P= Powertrain system, U= Network communication system.

1007_T012

Excerpt of a DTC Table (RX-8)

NOTE: Refer to the respective W/M for the correct DTC table.

Immobilizer System

List of Abbreviations

CAN	C ontroller A rea N etwork	RF-ID	R adio F requency- I Dentification
DDS 1	D iesel D iebstahl S chutz	RKE	R emote K eyless E ntry
DLC	D ata L ink C onnecter	SST	S pecial S ervice T ool
DSM	D iesel S mart M odule	VIN	V ehicle I dentification N umber
DTC	D iagnostic T rouble C ode	WDS	W orldwide D iagnostic S ystem
EPC	E lectronic P arts C atalogue	W/M	W orkshop M anual
HEC	H ybrid E lectronic C luster		
IC	I nstrument C luster		
MIS	M azda I mmobilizer S ystem		
OBD	O n- B oard- D iagnos T ics		
PATS	P assive A nti- T heft S ystem		
I-PATS	I ntegrated P ATS		
D-PATS	D istributed P ATS		
PCM	P owertrain C ontrol M odule		
PID	P arameter I Dentification		