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## Car Access System 3

Model: E70

Production: From Start of Production

# OBJECTIVES

After completion of this module you will be able to:

- Understand the operation of the Car Access System (CAS3) in the E70
- Locate and identify CAS components in the E70

## Car Access System 3

The Car Access System now features the 3rd generation of control units. The electronic vehicle immobilizer 4 (EWS 4) is also used in connection with the Car Access System 3. The previous functions of the electronic vehicle immobilizer 3 have been retained.

The Car Access System 3 can therefore be operated together with the electronic vehicle immobilizer 3 or 4. The digital motor electronics and the Car Access System 3 are incorporated in the overall electronic vehicle immobilizer system in the E70.

In addition, the electronic transmission control is used as a further immobilizer in the E70. The electronic vehicle immobilizer 4 improves the antitheft properties of the vehicle. A longer cryptic code is used for the data exchange.

The cryptic code provides the enable to start the engine. The Car Access System 3 is backwards compatible with the Car Access System 2. This means the functions of the Car Access System 2 are also included in the Car Access System 3.

The electronic vehicle immobilizer 3 or the electronic vehicle immobilizer 4 is used depending on the engine installed and the associated digital engine management.

The table below shows the assignment of the engine management to the respective electronic vehicle immobilizer.

| Vehicle | Launch Date | Engine   | Engine Management | EWS function |
|---------|-------------|----------|-------------------|--------------|
| E70     | 10/06       | N62B4801 | ME9.2.3           | EWS 3        |
| E70     | 10/6        | N52B3001 | MSV80             | EWS 4        |

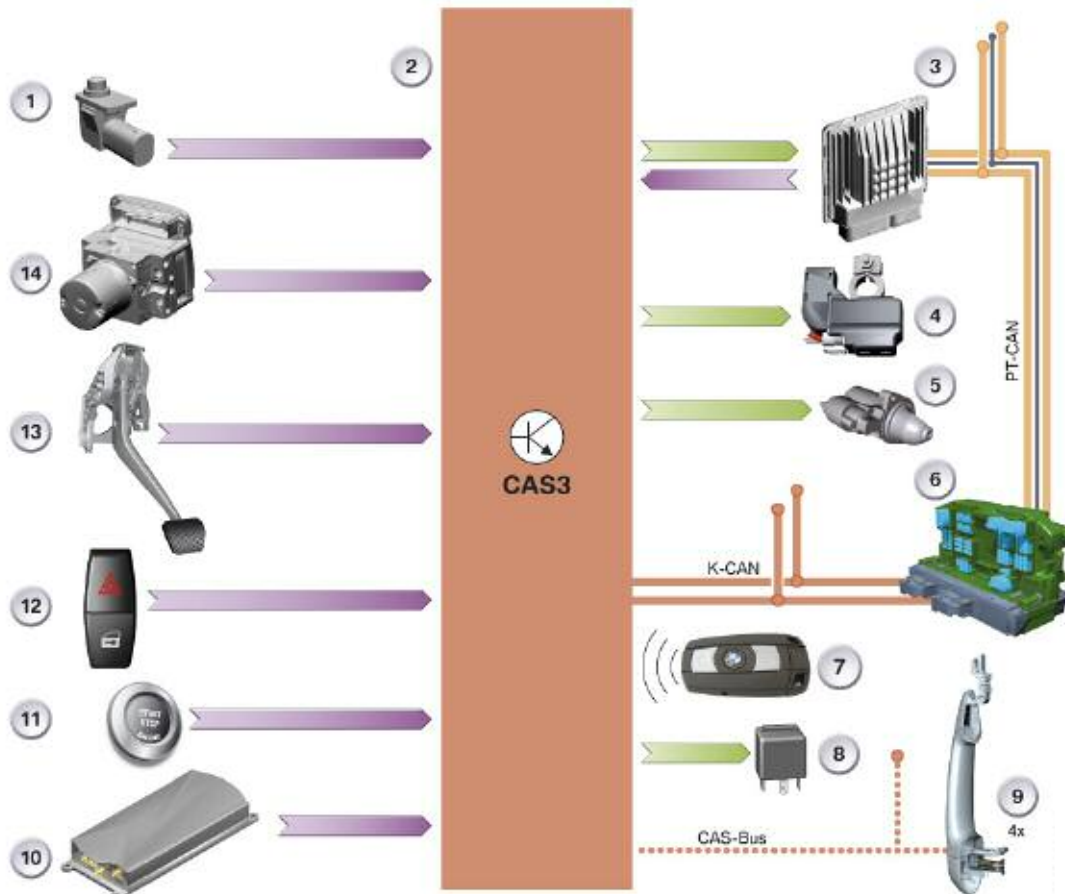
### History of the Car Access System

The Car Access System was used for the first time in the E65 (03/2002). It has undergone continuous further development and has been successively introduced in various BMW models.

The models include:

- E66 as from 09/2003
- E60 as from 03/2003
- E63 as from 09/2003
- E61 as from 04/2004
- E64 as from 04/2004
- E90 as from 03/2005
- E91 as from 09/2005.
- E60 M5 as from 03/2005
- E63 M6 as from 03/2005

## IPO Car Access System 3 (CAS 3)



The Car Access System 3 (2) is responsible for terminal control. For instance "Terminal 15 ON" is made available to the intelligent battery sensor (4). The terminal status, e.g. "Terminal R ON/terminal R OFF", can be selected with the START-STOP button (11).

The Car Access System 3 provides the start enable for the starter (5) in connection with the digital motor electronics 3 and the brake light switch (13).

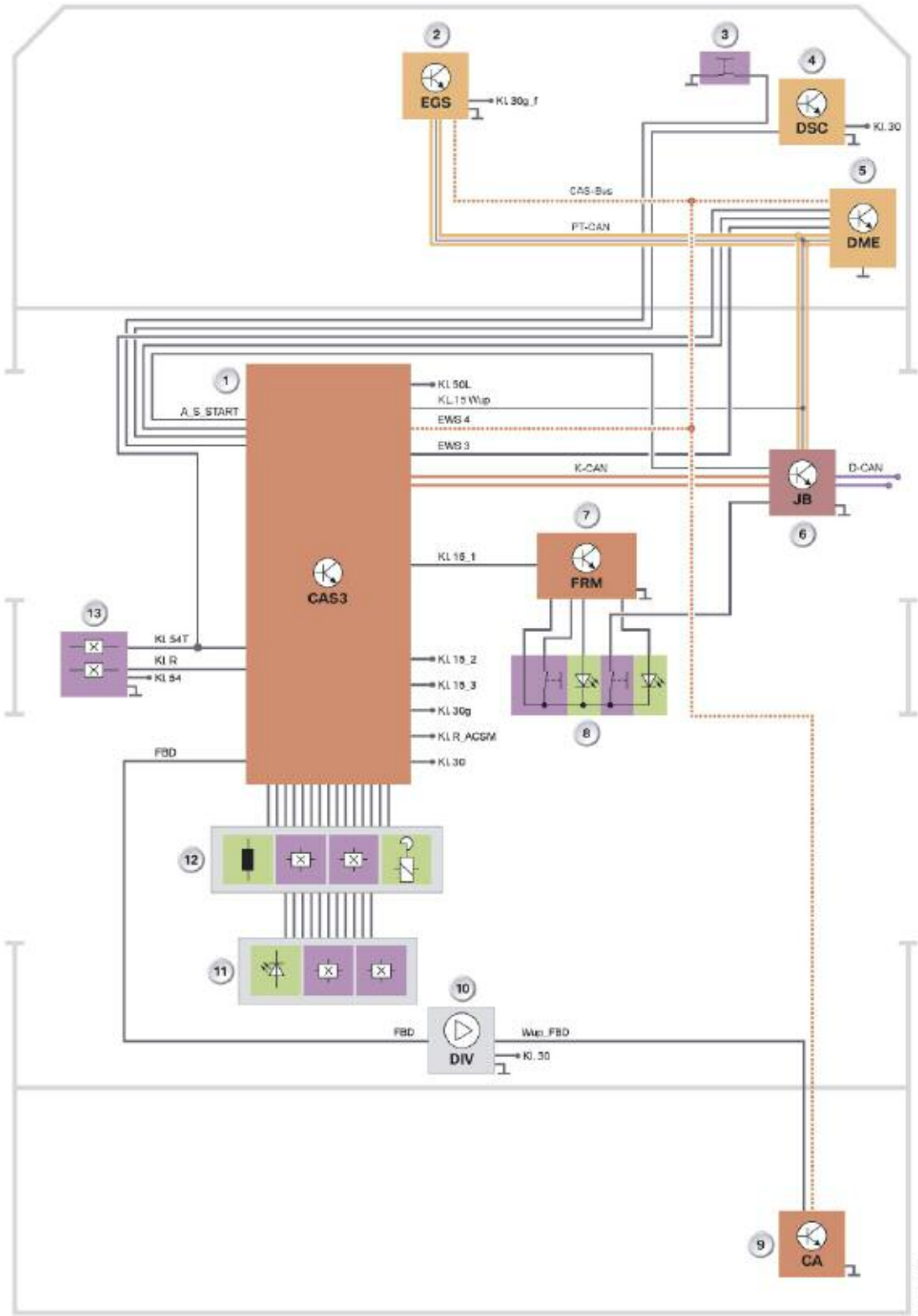
| Index | Explanation                         | Index   | Explanation               |
|-------|-------------------------------------|---------|---------------------------|
| 1     | Hood contact switch                 | 10      | Telematics Control Unit   |
| 2     | Car Access System 3                 | 11      | START-STOP button         |
| 3     | Digital Motor Electronics           | 12      | Central Lock Button       |
| 4     | Intelligent Battery Sensor          | 13      | Brake Light Switch        |
| 5     | Starter                             | 14      | Dynamic Stability Control |
| 6     | Junction Box Control Unit           | CAS-bus | CAS-bus                   |
| 7     | Identification Transmitter          | K-CAN   | Body-CAN                  |
| 8     | Terminal 15                         | PT-CAN  | Powertrain-CAN            |
| 9     | Electronic Outer Door Handle Module |         |                           |

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# System Circuit Diagram - CAS 3



## Legend for System Circuit Diagram - CAS3

| Index    | Explanation                                  | Index     | Explanation                      |
|----------|--|-----------|----------------------------------|
| 1        | Car Access System 3                          | KL15_3    | Terminal 15 (output 3)           |
| 2        | Electronic Transmission Control Module       | KL15 Wup  | Terminal 15 (wake-up)            |
| 3        | Hood contact switch                          | KL30      | Terminal 30                      |
| 4        | Dynamic Stability Control                    | KL30g     | Terminal 15 (switched)           |
| 5        | Digital Motor Electronics                    | KL30g_f   | Terminal 15 (switched, fault)    |
| 6        | Junction Box Control Unit                    | KL50L     | Terminal 50 load                 |
| 7        | Footwell Module (FRM)                        | KL54      | Signal, brake light switch       |
| 8        | Central-lock button/hazard warning switch    | KL54T     | Signal, brake light switch       |
| 9        | Comfort Access (CA)                          | CAS-bus   | CAS-bus                          |
| 10       | Remote control receiver in diversity module  | D-CAN     | Diagnosis CAN                    |
| 11       | START-STOP button                            | K-CAN     | Body CAN                         |
| 12       | Holder                                       | PT-CAN    | Powertrain CAN                   |
| 13       | Brake Light Switch (BLS)                     | A_S_START | Start/Start termination DME      |
| KLR      | Terminal R                                   | FBD       | Remote control services          |
| KLR ACSM | Terminal R, Advanced Crash Safety Management | WUP FBD   | Wake-up, remote control services |
| KL15_1   | Terminal 15 (output 1)                       | EWS 3     | Electronic Vehicle Immobilizer 3 |
| KL15_2   | Terminal 15 (output 2)                       | EWS 4     | Electronic Vehicle Immobilizer 4 |

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## Functional Overview

The Car Access System 3 is responsible for many functions, including the master for the following functions:

- Central locking
- Power windows
- Panoramic glass roof
- Comfort Access

The Car Access System 3 enables or interrupts the execution of the aforementioned functions.

| The control units which execute the functions are: |                      |
|--|----------------------|
| Junction Box control unit                          | Central Locking      |
| Footwell Module                                    | Power Windows        |
| Roof Functions Center                              | Panoramic Glass Roof |
| Comfort Access                                     | Comfort Access       |

Further functions are integrated in the Car Access System 3.

They are:

- Terminal control
- Electronic vehicle immobilizer 4
- Vehicle data storage



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## Terminal Control

The remote control must be inserted and locked in its slot in order to activate terminal control. The vehicle then automatically receives the terminal status "terminal R ON."

The terminals can now be changed with the START-STOP button in the following order:

- Terminal 15
- Terminal R
- Terminal 30
- Terminal R
- Terminal 15

Note: This order is only possible when the brake pedal has not been pressed on automatic transmission vehicles. As soon as the brake pedal is pressed, the engine will start the next time the START-STOP button is pressed.

## Terminal Control (in Comfort Access)

On vehicles equipped with Comfort Access, the identification transmitter need only be located in the vehicle interior and need not be inserted in the holder. The identification transmitter is detected by the antennas in the vehicle interior. Provided the vehicle was left in a correct manner, the terminal selection will start with the status "terminal 30".

Provided the brake pedal has not been pressed, it is now possible to switch through the terminals one after the other by pressing the START-STOP button.

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## Electronic Vehicle Immobilizer 3 (EWS 3)

The familiar functions of the previous electronic vehicle immobilizer 3 have been retained. The Car Access System 3 is integrated in the system network via the K-CAN. The vehicle key data are read into the Car Access System 3 via the key slot.

Pin 20 is used in connection with the Car Access System 3. The enable code is signalled to the digital motor management via this pin.

The Car Access System 3 contains the start relay that is activated by means of an integrated circuit. The integrated circuit is informed via a separate line (A\_S\_Start) that the digital engine electronics is ready to start. Furthermore, the start procedure is terminated via the A\_S\_Start line if the engine does not start up because, for example, there is a fault in the PT-CAN system. Data transmission is unidirectional.

## Electronic Vehicle Immobilizer 4

The electronic vehicle immobilizer 4 is an immobilizer system that prevents unauthorized engine start. It was used for the first time in the Car Access System 3 in the E92.

The electronic vehicle immobilizer 4 uses a new, modern encryption system. A 128 bit long secret key is assigned to each vehicle and stored in the BMW database. This secret key is known only to BMW. The secret key is programmed and locked in the Car Access System 3 and in the digital engine management.

Once entered in the control unit, the secret key can no longer be changed, deleted or read. This therefore means that each control unit is assigned to a specific vehicle.

The electronic vehicle immobilizer 4 operates with bidirectional and redundant data transmission. The K-CAN (CAN protocol) and CAS-bus (K-bus protocol) are used for this purpose.

Pin 30 of the Car Access System 3 serves as the connection to the CAS-bus. The redundant data transmission enables operation of the electronic vehicle immobilizer even if a bus system fails due to a defect.

### Design of EWS 4

The vehicle immobilizer consists of the identification transmitter which identifies itself to the vehicle and therefore to the Car Access System 3. The Car Access System 3 exchanges data via the CAS-bus with the digital motor electronics and thus cancels the immobilizer function.

The software for the electronic vehicle immobilizer as well as the enable for the starter is resident in the CAS 3. The digital engine management is responsible for issuing the enable for the ignition and fuel injection.

The gearbox functions are enabled by the electronic transmission control. The remote control or the identification transmitter must be identified as matching the vehicle before the electronic vehicle immobilizer issues the start enable. This already takes place before a vehicle is unlocked.

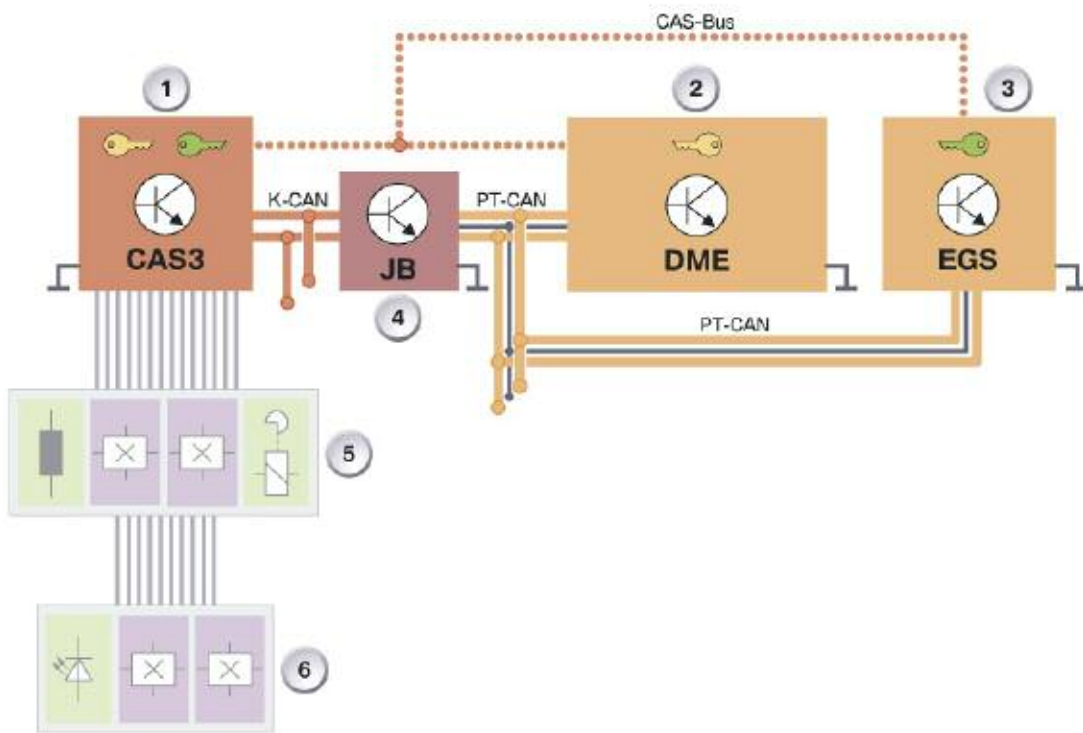
A renewed check (authentication) must be performed as soon as an attempt is made to start the engine. The check establishes whether the remote control matches the vehicle or the identification transmitter is located in the vehicle interior.

The vehicle can be started if the check is successful. Authentication starts with the status "Terminal 15 ON".

Note: The start enable can be given only by a remote control matching the vehicle or a suitable identification transmitter.

### Start Enable through EWS

The start procedure is enabled by means of a special request and response procedure known as challenge-response. As from "Terminal 15 ON", the digital engine management sends an encrypted random number to the CAS 3. The digital engine management generates the random number in a random number generator.



| Index | Explanation                     | Index | Explanation               |
|-------|---------------------------------|-------|---------------------------|
| 1     | Car Access System 3             | 4     | Junction Box Control Unit |
| 2     | Digital Motor Electronic        | 5     | Key Slot                  |
| 3     | Electronic Transmission Control | 6     | START-STOP Button         |

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From this random number together with its secret key, the Car Access System calculates a response and sends it to the digital engine management. In the meantime, the digital engine management calculates the expected response from the random number with its secret key.

The Car Access System 3 and the digital engine management use the same secret key and algorithm for the calculation. The electronic vehicle immobilizer is cancelled if the value which the CAS 3 sends to the digital engine management agrees with the value calculated by the engine management.

The engine can now be started.

Note: As from "Terminal 15 ON", a cyclic query (challenge-response) is performed as long as the engine is not yet running. A fault code is entered in the CAS 3 if there is no query from the digital engine management approximately 10 seconds after the start of the request.

#### ■ Data Transmission

Data transmission is redundant via the bus systems. The signal from the digital engine management reaches the CAS 3 via the K-CAN and the CAS-bus. The digital engine management, however, is connected to the PT-CAN. For this reason, the signal is sent via the gateway of the junction box control unit to the K-CAN. The runtime of the signals via the bus systems is of no significance as the signal that reaches the digital engine management first is used for the electronic vehicle immobilizer.

The authentication is repeated in response to following events:

- Transmission and response time exceeded
- Transmission problems
- Response with the secret security code incorrect (e.g. incorrect secret key due to control unit from another vehicle).

#### Secret Key

The control units are assigned a secret key on the assembly line. This secret key is generated from a random number. The secret key is valid for a pair of control units and linked to the specific vehicle. This means that one pair of control units receives the same secret key. Once the secret key has been entered, the control unit is locked. From this point on, the control unit is permanently tied to this secret key and the vehicle. The CAS 3 and the digital motor electronics form one pair of control units.

Note: Since the control units are assigned to the specific vehicle, replacement with a unit from another vehicle is not possible. When replacing a control unit, the new control unit must be ordered from BMW. Matching of the control units to each other is no longer necessary.

## Gearbox Enable

The enable is based on a procedure similar to that used for EWS 3. As from "Terminal 15 ON", the CAS 3 sends encrypted individual codes to the electronic transmission control. The electronic transmission control deciphers and checks these individual codes. If the check is successful, the gearbox control unit will enable the gearbox functions.

The electronic gearbox control unit forms a pair of control units together with the CAS 3.

### Start Value Matching

A start value matching procedure between the CAS 3 and the electronic transmission control is performed on the assembly line. As part of this procedure, the CAS 3 transfers in encrypted form an individual code to the electronic transmission control.

Consequently, the electronic transmission control knows the individual code and can check whether the gearbox functions can be enabled.

### Emergency Release

The parking lock cannot be released in the event of a defect or data transmission error. For this reason, the E70 features a mechanical emergency release facility for the parking lock. A handle for the emergency release of the parking lock is located in the luggage compartment.

This handle must be plugged in under the left cup holder, turned through 90° and pushed down. The gearbox is released as soon as the handle has been locked in position. The vehicle can now be towed but not driven.

Note: The handle must remain locked in position while the vehicle is being towed. The parking lock will engage if the handle is removed while the vehicle is being towed. This could cause an accident in unfavorable towing situations.



| Index | Explanation |
|-------|-------------|
| 1     | Turn Handle |
| 2     | Push Handle |

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## Vehicle Data Storage

The Car Access System 3 stores the following vehicle data:

- Personal Profile, the Car Access System 3 stores data for the Personal Profile
- Vehicle order, the vehicle order is stored in the footwell module
- Redundant data storage for instrument cluster
- Data for condition-based service CBS
- Authentication for diagnosis access to vehicle

### Data for Condition-based Service

The data for condition-based service are stored and transferred to the remote control. This data can be read out via the key reader for service purposes. The data for the condition-based service are updated during vehicle operation.

The data in the fault code memory are also updated during vehicle operation.

The conditions are:

- "Terminal 15 ON", Speed above 50 km/h and below 30 km/h
- The data are updated after covering a distance of 10 km and at a speed below 30 km/h.

### ■ Manual Update of CBS Data

The procedure for transferring current data to the remote control during servicing is as follows:

- Insert remote control in its holder
- Press and hold center-lock button and select "terminal 15 ON" with the START-STOP button.
- After 15 s the CBS data will have been transferred to the remote control.
- Read out remote control.

### ■ Manual Update of Fault Memory Data

The procedure for transferring current data to the remote control during servicing is as follows:

- Press and hold center-lock button
- Insert remote control in its holder
- Select "Terminal 15 ON" with the START-STOP button
- The fault code memory data are transferred to the remote control after 15 seconds.
- Read out remote control.

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## Control Unit Replacement

A defect in the control units belonging to the EWS represents a challenge for the Service technician. Since a defective control unit cannot be replaced by control units from other vehicles particular care is necessary when performing the diagnostic procedure.

A defective control unit can be ordered through spare part channels. However, it is important to bear in mind that the digital engine management and the CAS 3 were supplied already coded to the vehicle.

This has the advantage that only the control unit is replaced and the matching procedure with the electronic vehicle immobilizer is not necessary. There is no point in ordering a control unit to be kept in stock as the secret key is assigned to the control unit and the vehicle.

A matching procedure is necessary for the electronic transmission control after replacement. As part of this procedure, the CAS 3 transfers the individual code to the electronic transmission control.

Note: The matching procedure can take several minutes.

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