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E70 Advanced Crash Safety Module Workbook

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Advanced Crash Safety Module (ACSM)

Model: E70

Production: From Start of Production

OBJECTIVES

After completion of this module you will be able to:

- Demonstrate the function of the ACSM system
- Identify the different types of air bags used on the E70
- Demonstrate the Driver Seat Calibration on the E70

Advanced Crash Safety Module

The safety system (ACSM) is used in the E70. The task of ACSM is to detect accident situations critical for the vehicle occupants and to activate the necessary restraint systems selectively corresponding to the crash severity.

The crash safety module performs internal diagnosis and monitors all inputs and outputs. Any faults that may occur are stored non-volatile in the crash safety module and indicated to the driver by way of the airbag indicator lamp in the instrument cluster.

Communication with other control modules in the vehicle's system network takes place via the K-CAN and the F-CAN.

In the event of a crash, a K-bus telegram is transmitted (provided a telephone is installed) via an additional separate data line to the Telematics Control Unit (TCU) and the emergency call triggered.

It is possible to encode the crash safety module via the K-CAN. Diagnosis of the crash safety module takes place via the diagnosis CAN to the gateway that is located in the Junction-box ECU on the E70.

Front Airbag, Driver

In conjunction with the seat belt, the driver's front airbag is designed to reduce the risk of serious injury to the driver's head or thorax during a head-on collision. The front airbag for the driver's side is located in the hub cushion of the steering wheel. The driver front airbag is equipped with a 2-stage inflator assembly.

The two stages of the airbag are triggered with a time delay depending on the crash severity and use of seat belt. The two stages of the inflator assembly facilitate a restraint function adapted to the crash severity and consequently reduce additional stress on the occupants during the development phase.



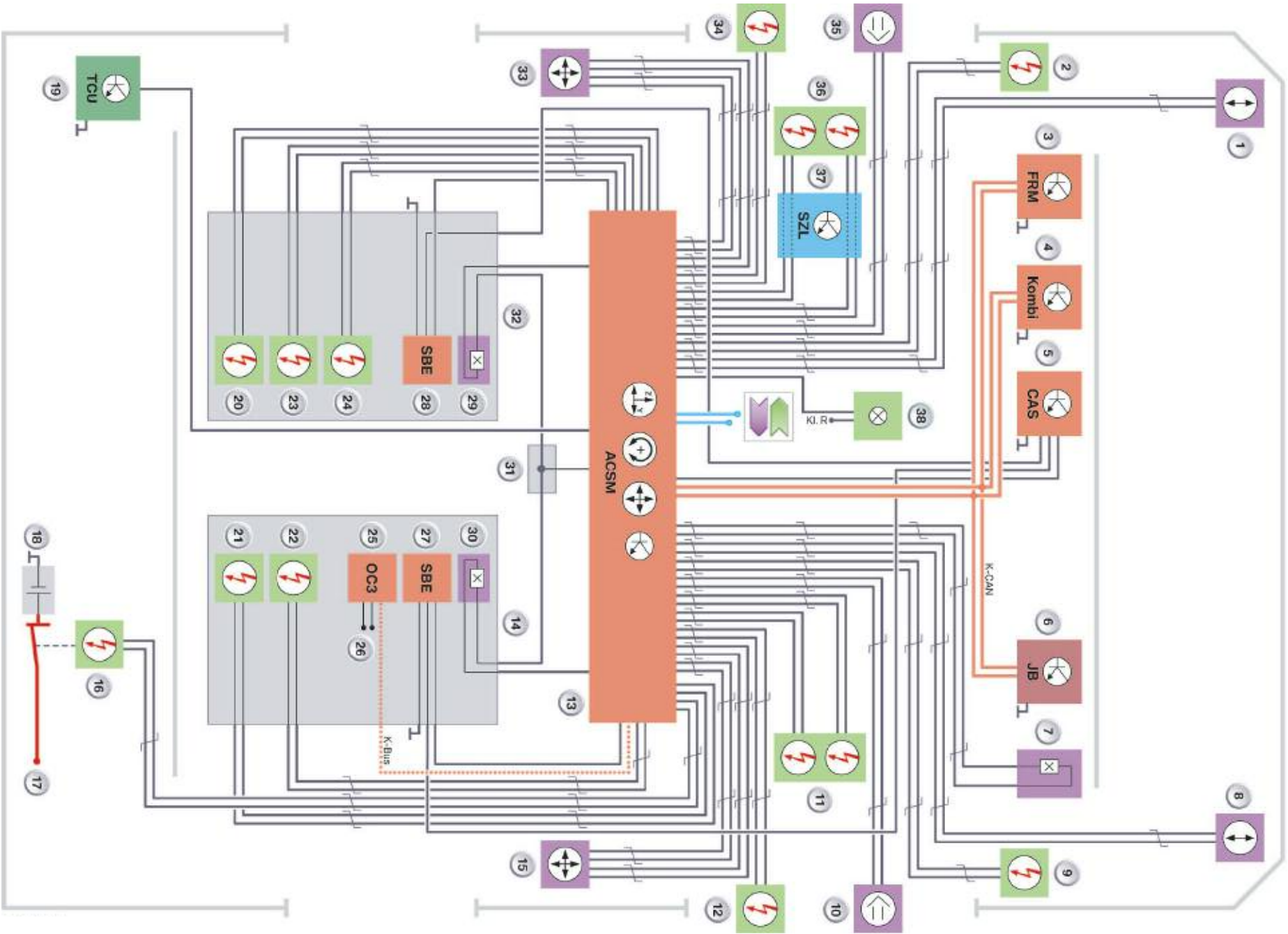
Index	Explanation
1	Connection of firing pellet, first stage
2	Connection of firing pellet, second stage

Front Airbag, Passenger

Together with the seat belt, the task of the front airbag on the passenger's side is to reduce the risk of serious injury to the front passenger during a frontal crash. The 2-stage front airbag on the passenger's side is located under the instrument panel.

Deployment of the front passenger airbag breaks the instrument panel at defined points and opens a flap, which is connected to the instrument panel by means of a fabric strap. The passenger airbag opens in the direction of the windshield. The passenger airbag emerges in an upward direction and is supported on the windshield and on the instrument panel.

ACSM Circuit Diagram



ACSM Circuit Diagram Legend

Index	Explanation
1	Up-front sensor, left
2	Head airbag, front passenger's side
3	Footwell module FRM
4	Instrument cluster
5	Car Access System (CAS)
6	Junction-box ECU
7	Switch for passenger airbag deactivation
8	Up-front sensor, right
9	Head airbag, driver's side
10	Door pressure sensor, right
11	Front passenger airbag, 2-stage
12	Adaptive seat belt force limiter, right
13	ACSM ECU
14	Front passenger's seat
15	B-pillar satellite, right
16	Safety battery terminal
17	Main power connection to starter and alternator
18	Ground
19	Telephone
20	Seat belt pre-tensioner, left
21	Seat belt pre-tensioner, right
22	Side airbag, right
23	Side airbag, left
24	Anchor-fitting pre-tensioner
25	Seat occupancy detector
26	Power supply, seat occupancy detector
27	Seat occupancy detector (SBE for EU), front passenger
28	Seat occupancy detector (SBE for EU), driver
29	Seat belt buckle switch, driver
30	Seat belt buckle switch, front passenger
31	Ground point
32	Driver's seat
33	B-pillar satellite, left
34	Adaptive seat belt force limiter, left
35	Door pressure sensor, left
36	Driver's airbag, two-stage
37	Steering column switch cluster SZL
38	Indicator lamp for passenger airbag deactivation
K-CAN	Body CAN
K-Bus	Body Bus
KL R	Terminal R

Curtain Airbag

The well-proven curtain airbag is used as the head protection system in connection with the ACSM on the E70.

The curtain airbag extends from the A-pillar up to the C-pillar and covers the entire side section at head level. The curtain airbag inflates between the occupants and side windows or side trim panels.



In connection with the side airbag in the front seat, it provides optimum protection for the occupants in the event of side impact.

The curtain airbag reduces the movement of the head and other extremities towards the outside during a side crash. This results in lower neck shear forces as well as bending moments in the cervical vertebrae. In addition, it also prevents direct head contact with the side structure of the vehicle.

The inflator assembly (gas generator) mounted between the B-pillar and C-pillar is triggered in the event of a side crash. The gas flows out of the pressure vessel through the two gas lances into the curtain airbag.

Simultaneously filling the curtain airbag at the front and rear ensures the air cushion is filled uniformly.

The head airbag is brought into position because of the way the curtain airbag is mounted on the A-pillar and the C-pillar. The curtain airbag extends between the side window and side trim panel and the occupants.

The closed system retains the structural strength and stability of the curtain airbag for several seconds

Side Airbag

For many years now, the side airbag has been used by BMW as an important integral part in occupants safety and protection systems. The task of the side air bags is to minimize the risk of injury to the driver/front passenger in the trunk/torso area in the event of a side impact.

The side air bags are mounted in the backrest of the front seats with the aim of achieving optimum interior functionality and appealing design in the E70 while also satisfying the demanding safety requirements. The task of the side air bags is to minimize the risk of injury to the driver/front passenger in the pelvic and trunk/torso area in the event of a side impact.



The side airbag is triggered in response to a sufficiently strong impact from the side. The side airbag emerges through the tear seam in the backrest of the seats and inflates between the door and occupant. The air cushion between the door and occupant provides controlled damping and therefore reduces load/strain on the occupant.

Crash Safety Module

The advanced crash safety module essentially comprises the following components:

- Crash safety module
- Sensors and switches
- Actuators

The crash safety module consists of a die cast housing with integrated plug cover.

The crash safety module contains various sensors:

- Rollover sensor
- Low-g sensors
- Longitudinal and transverse acceleration sensors



The advanced crash safety module has a comprehensive sensor system. Transverse acceleration sensors in the B-pillar and door pressure sensors are used for the purpose of side crash detection. The B-pillar satellites also have longitudinal acceleration sensors for front and rear-end crash detection.

Note: The crash safety module is located on the transmission tunnel behind the hand brake. Various sensors (rollover, Low-g as well as longitudinal and transverse acceleration sensors) are integrated in the crash safety module and the crash safety module is integrated in the K-CAN.

Rollover Monitoring System

The rollover protection system is an important instrument for improving occupant protection in the event of the vehicle rolling over. The seat belt pre-tensioners and the curtain air bags are triggered in response to corresponding crash severity. The crucial factors which determine whether the car overturns are not just the angle but also the angular velocity at which the car is set into the roll. All these vehicle movements can also occur after a front-end, side-on or rear-end crash.

Note: The front passenger air bags are not deployed when the front seat is not occupied. However, this is not indicated by the Passenger Airbag OFF light.

Seat Position Detection

In accordance with US legislation a system for recognizing the size of occupants must be provided for the driver's seat. This size recognition function is based on the adjustment range of the forward/backward seat adjustment. On the E70, the exact position is determined by the actuator motor in the driver's seat.

Seat-position Recognition

Seat-position recognition indicates where longitudinally the seat is situated (distance to the steering wheel). In this way, the distance between the driver and the steering wheel can be detected.

The ACSM requires this information so that it can fire the airbag under defined conditions.

Seat-position recognition is calibrated at the factory. The positions in the front and rear longitudinal seat direction are known to the seat module. A maximum distance is available for longitudinal seat adjustment.

This stretches from the mechanical front stop to the mechanical rear stop. The motor for adjustment in the longitudinal direction generates Hall pulses over this distance. The seat module uses these Hall pulses to identify the current (absolute) seat position.

An area for example in which a person would sit is defined in the longitudinal direction. The absolute seat position can be lost due to specific causes. The seat must therefore be calibrated.

Calibration of Driver Seat

The position of the driver seat in the longitudinal direction can become implausible in the course of that seat's life. This can be caused by repeatedly moving the seat forward and back.

These movements can give rise to an unauthorized position delta which no longer provides for a determination of the seat position.

The seat must therefore be recalibrated. Calibration is easy and can be performed by the customer him/herself following the steps in the Owner's manual.

Note: These steps should turn off the Check Control Message, if not, repeat the process and if this doesn't work the system must be checked.




If the seat is unable to reach the mechanical front stop, the calibration must be performed in the service workshop.

This situation can come about if, a coin is stuck in the seat-adjustment rail and blocks the adjustment travel.

When repairs are made to the seat, the seat must always be calibrated. This is necessary to guarantee seat-position recognition, or more precisely to increase the safe and reliable function of seat-position recognition.

Switching the seat module for test purposes for example with one from another vehicle is possible. The seat calibration will be lost however. Because the possibility of the calibration being in order when the old seat module is reinstalled cannot be ruled out, it is necessary to calibrate the seat.

Note: For further details please refer to BMW Service Information.

Check Control Message	Meaning	Information in Central Information Display
	Seat must be recalibrated.	Seat calibration necessary.
	Seat-position recognition malfunctioning!	Seat-position recognition malfunctioning! Have the system checked by BMW Service at the next available opportunity.
	Rear seat not locked!	Rear seat/Backrest Left or right rear seat not locked. Increased risk of injury in the event of an impact because seat belt is ineffective!

The ACSM outputs a check control message via the K-CAN to the instrument cluster.

The seat module can also trigger the check control message. This is possible if for instance the Hall sensor of the longitudinal drive motor is defective. The seat must be calibrated after the repair.

Note: The ACSM receives a message from the seat module via the K-CAN once a second as to whether calibration of the seat is necessary.



Workshop Exercise - Seat Detection

Using an E70 shop vehicle perform the "Driver Seat Calibration"

How do we know that the Driver seat is out of calibration?

STEP 1

Move the driver seat forward until it comes to a complete stop.

STEP 2

Move the driver seat forward once again (note a small amount of additional movement.)

STEP 3

Set the driver seat to the desired adjustment position.

What procedure is to be followed if the Check Control Message does not go out?
