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ANTI-THEFT ALARM SYSTEM (DWA)

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ANTI-THEFT ALARM SYSTEM (DWA)

Model: E65 - 745i

Production Date: 11/2001 - Start of Production

Objectives:

After completing this module you should be able to:

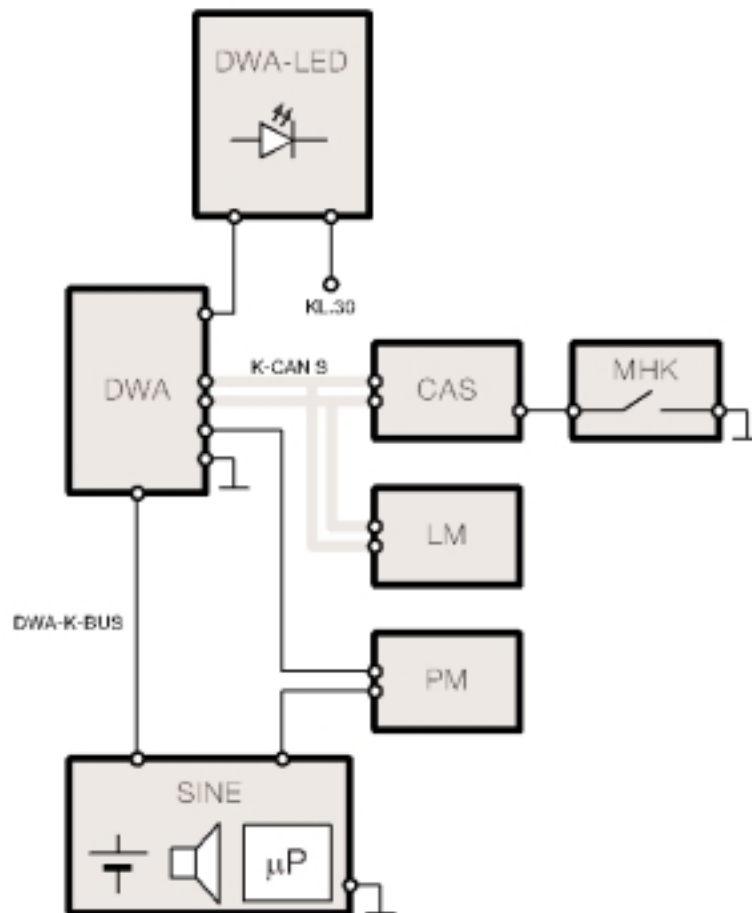
- Know what components that are used in the DWA system.
- Understand how the DWA communicates with the siren and the rest of the vehicle electronic system.
- Explain the effect that the hotel switch has on the DWA.

Purpose of the System

The anti-theft alarm system (DWA) has the purpose of indicating attempts to break into the vehicle, or to tamper with it. Acoustic and visual alarms are used to draw attention to the vehicle and frighten off any would be car thief or vandals.

A distinction must be made between the DWA and the Electronic Immobilizer System (EWS). The purpose of the anti-theft alarm system is to deter a thief from entering the vehicle. The purpose of the EWS system is to prevent a thief from driving the vehicle off under it's own power.

System Overview

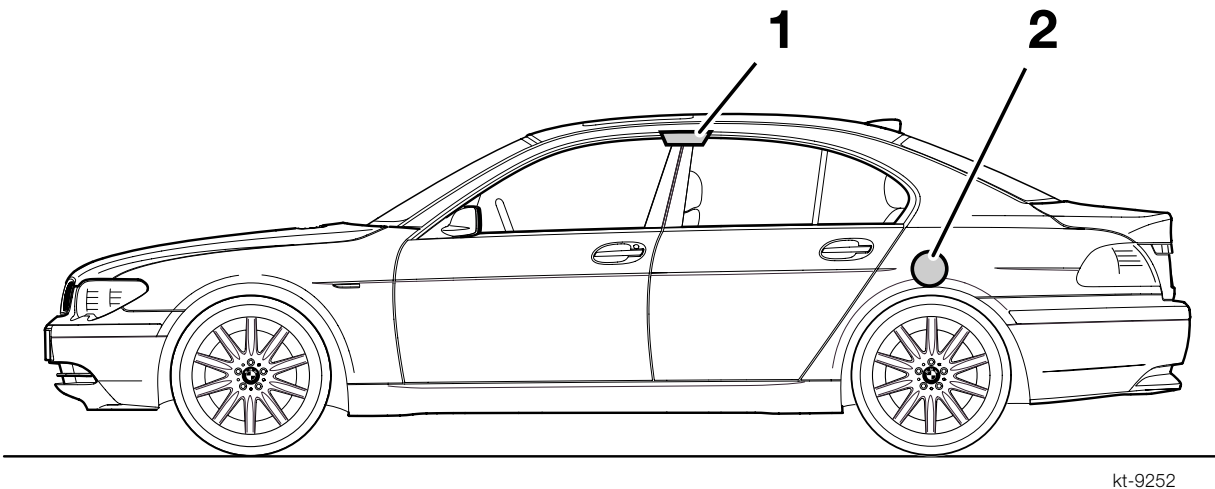


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Index	Description	Index	Description
MHK	Hood switch	DWA	Anti-theft Alarm
CAS	Car Access System	DWA-K-BUS	Local data bus for DWA
LM	Light Module	SINE	Emergency siren with integrated tilt sensor
K-CAN-S	K-CAN-System		

The DWA control unit with integrated interior sensor (1) is located in the rear lights roof console housing in the center of the headliner. This central location allows the entire vehicle interior to be monitored very effectively.

The emergency siren with integrated tilt sensor (2) is installed in the left rear wheel arch where good protection is provided against tampering with the emergency siren or DWA K bus.



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Components

The new DWA system of the E65 consists of the following components:

- Interior protection sensor with integrated DWA logic (DWA control unit).
- Emergency siren with integrated tilt sensor (SINE).
- DWA LED under the rear view mirror.
- Integration with vehicle electronics (e.g. hood or door contacts).

The interior sensor with integrated DWA logic and the emergency siren with integrated tilt sensor are new developments combining the functions of the previous systems.

Both components now have diagnostic capability. The interior sensor is connected directly to the K-CAN system. The tilt sensor (with emergency siren) is connected to the interior sensor via a sub-bus line (local data bus).

The interior protection sensor is an ultrasound-based (USIS) motion detector which detects all movements inside the vehicle interior and evaluates them using the DWA logic.



The DWA control unit is supplied voltage by the Power Module (KL 30).

For reasons of safety, KL 30 is not disconnected for the DWA by the Power Module when consumer cutoffs are performed.

Arming of the DWA is not possible at KL R or KL 15.

Emergency Siren with Integrated Tilt Sensor (SINE)

The emergency siren communicates with the DWA over a bi-directional line (DWA K bus). The emergency siren is flashable and has diagnostic capability.

If the alarm is triggered, the emergency siren issues an acoustic signal. A short acoustic signal is also triggered when locking/unlocking.



Detected alarm triggers are communicated to the DWA control unit, which then activates the alarm.

The emergency siren has an independent voltage supply and additionally monitors the voltage supplied of the vehicle battery. It also monitors tampering with any of its own connector leads.

The independent voltage supply allows the emergency siren to generate an alarm when the vehicle voltage supply is disconnected.

The independent voltage supply is provided by rechargeable lithium cells.

The emergency siren can detect:

- A voltage drop in the vehicle battery due to a break in the wiring
- A voltage higher than 16 V
- A voltage drop from a value of 7.5 V to 6.5 V in less than 40 minutes

When armed, the emergency siren monitors the vehicle voltage over the range $6.5\text{ V} < +U_b < 16\text{ V}$. If the actual voltage value drops below or exceeds these values, the independent alarm is generated immediately.

The emergency siren monitors the connecting lines +U_b, GND (ground) and DWA K bus. If these line are cut, the independent alarm is sounded immediately.

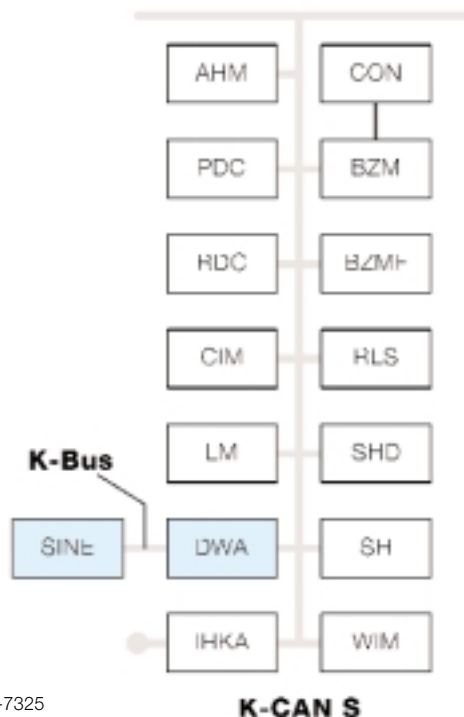
The tilt sensor monitors the horizontal position of the vehicle and also has the task of detecting tire and wheel theft as well as attempts to tow away the whole vehicle.

The present parked position of the vehicle is stored together with the components "longitudinal angle" and "transverse angle". If a defined change of angle is exceeded in the longitudinal direction and/or the transverse direction, an alarm telegram is sent to the DWA interior sensor.

After the initial alarm is generated, the alarm sensitivity is raised, the result is that a second alarm is triggered with less movement.

DWA LED

The DWA LED is activated directly by the DWA control unit.



DWA K bus

The DWA K-bus is a local Sub-bus. Communication uses K bus specifications.

The DWA communicates with the emergency siren or the tilt sensor over the DWA bus.

Principle of Operation

Monitoring

The DWA monitors the following signals:

- Door and lid signals (trunk lid and hood contact)
- Vehicle interior (USIS)
- Vehicle inclination tilt
- DWA bus line leading to emergency siren (SINE)
- Voltage supply for vehicle electrical system (SINE)
- Voltage level at the emergency siren (SINE)
- Battery distribution switch

The DWA continues to evaluate the following vehicle operating states so that it can adapt its sensitivity to increase safety against false alarms.

- Status of independent ventilation (parked car ventilation)
- Position of windows
- Position of sunroof

Open windows, for example, lower the sensitivity of the operating threshold.

Arming the DWA

The DWA is armed from the driver's door or by the Remote Control when the vehicle is double-locked. The DWA is armed as soon as the locked status sent by the CAS over the K-CAN-S is confirmed. The following phases are involved:

Immediately after arming:

- The emergency siren is armed and monitors its voltage supply.
- The DWA commences line monitoring on the local DWA K bus.

3 Seconds after arming:

- Each of the door and lid contacts to be monitored is included in the alarm table after having been in the rest position for 3 seconds.
- Faulty contacts are evaluated as closed, but are not included in the alarm table.

3 seconds after double-locking the vehicle or after locking the last door or lid:

- The referencing phase of the tilt sensor and interior sensor starts.
- The sensitivity level is set depending on the window and sunroof position.
- If the trunk lid is opened during the referencing phase, the referencing phase is interrupted and re-started after the trunk lid is locked.

20 seconds after locking the last door or lid:

- The interior sensor is included in the alarm table when its referencing period is completed.

30 seconds after locking the last door or lid:

- The tilt sensor is included in the alarm table when its referencing period is completed.
- If no acknowledgement telegram is received from the tilt sensor within 60 s of arming, this signal is deleted.
- If at least one input signal is not in idle state or if a sensor is defective, this is signalled by the flashing LED.

Deactivation of the Tilt Sensor and Interior Sensor

The interior sensor and the tilt sensor can be deactivated to prevent the alarm from being triggered by the tilt sensor during transportation by ship or train when the anti-theft alarm system is armed.

It also helps to prevent animals left in the vehicle from triggering the alarm via the interior sensor. This can be done by again double-locking the vehicle within 10 seconds of arming the vehicle.

The LED comes on for 1 s to acknowledge the deactivation. It is possible to deactivate the tilt sensor and the interior sensor using VKM.

Disarming the DWA

The DWA is disarmed when the central locking system (CAS master) telegrams: "locked" and "selectively unlocked."

The emergency siren with tilt sensor is disarmed. If an alarm situation occurs during the period in which the DWA was armed, this is acknowledged via a flashing DWA LED.

Unlocking the Luggage Compartment

If the luggage compartment in an armed vehicle is opened using the Remote Control, the tilt sensor and the interior sensor are deleted from the alarm table (the tilt sensor is deactivated via the DWA K bus by telegram).

If the luggage compartment is unlocked and opened during the referencing phase of the interior sensor and the tilt sensor, the referencing phase is aborted, since loading the vehicle can produce new vehicle operating states. The referencing phase for the interior sensor and the tilt sensor is restarted 3 seconds after locking the trunk lid.

Unlocking the luggage compartment using the emergency lock cylinder does not disarm DWA.

Forced Disarming

The DWA is automatically disarmed if a person located in the vehicle double-locks the vehicle and then inserts the key into the ignition. The CAS evaluates this action and sends a "locked" telegram. The DWA is then disarmed.

Hotel Setting

The vehicle can be armed in **"hotel setting active"** status. This is done by moving the hotel slide switch to the locked position and then locking the center console storage area with the mechanical key.

If the vehicle is unlocked with **"hotel setting active"** status, the DWA is not disarmed completely. The trunk lid, hood contact and line monitoring triggers for the emergency siren are still monitored.

Since the DWA is not disarmed completely, no acoustic acknowledgement is given.

To disarm the hotel setting, the hotel switch must be moved to the un-locked position and the vehicle must be locked and then unlocked so that the DWA will receive the change in status message from the CAS. Otherwise the alarm will sound when the trunk or hood is opened.

DWA LED

The DWA LED indicates the state of the DWA to the vehicle user.

DWA state	DWA LED
Disarmed	OFF
Armed	ON
Armed, input is not in rest position	Flashes rapidly for max. 10 s and then remains on.
Interior sensor/tilt sensor OFF	Lights up for 1 s and then remains on.
Alarm triggered	Flashes rapidly for 5 min and then remains on.
Disarm	Goes off.
Disarm after alarm	Flashes for 5 min.

Alarm Triggers

Door Contact Signals

The status of the door contacts is evaluated by the CAS and transmitted by K-CAN-S telegram. The status of the individual door contacts is included in the alarm table 3 s after the status signal "door closed" is generated.

It is possible to trigger an alarm via a closed door even if another door contact is still open.

In the case of faulty or implausible lid signals, the CAS assumes that the contact is closed.

Trunk Lid

The status of the trunk lid contact is evaluated by the CAS (from the PM) and transmitted to the DWA by telegram.

If the trunk lid is unlocked when the DWA is armed, then signals from the trunk lid contact, interior sensor and tilt sensor are deleted from the alarm table.

Three seconds after the trunk lid is locked, the trunk contact is re-included in the alarm table and the referencing period of the interior sensor and tilt sensor commences (provided no other door or lids are opened).

Hood

The status of the hood contact is evaluated by the CAS and transmitted by telegram. The status of the hood contact is included in the alarm table 3 s after the status signal "hood closed" is generated.

Interior Sensor

The interior sensor monitors movements in the passenger compartment of the vehicle. The referencing phase of the interior sensor begins 3 seconds after locking the last doors and lids.

The interior sensor is ready 20 seconds after the referencing period begins. The trigger is included in the alarm table.

Tilt Sensor

The referencing phase of the tilt sensor is started by a telegram from the DWA 3 seconds after locking the last doors and lids. The tilt sensor is ready 30 seconds after commencement of the referencing period and indicates this to the DWA. The trigger is now included in the alarm table.

If no acknowledgement telegram is sent from the siren/tilt sensor, this is registered in the memory of the DWA and the tilt sensor is not included in the alarm table.

If the ready tilt sensor detects an alarm trigger situation, it informs the DWA using a DWA K-bus telegram. The DWA decides whether to generate the alarm or not based on the pre-defined criteria.

The tilt sensor alarm is stored in the DWA interior sensor. To prevent a false alarm from triggering caused by a rocking motion of the vehicle, the angular data for the longitudinal arm and control arm are detected every 90 ms. An alarm is only triggered if the vehicle remains at a certain inclination for a sustained period of time (approx. 1.5 s).

Battery Switch

If the DWA receives the "Storage mode" telegram from the Power Module (change of signal edge from inactive to active) in the armed state, an alarm is triggered.

If the DWA receives the "Storage mode" telegram in the disarmed state, the DWA can be armed as usual. The tilt sensor and interior sensor remain active.

Self-Monitoring of Siren

The self-monitoring function is implemented in the siren. The siren triggers an independent alarm under the following conditions:

- An independent alarm may be triggered only once for each arming cycle.
- The self-monitoring of the emergency siren is started as soon as the DWA is armed. The emergency siren monitors its own power supply and identifies under-voltage, over voltage and open circuits.
- If the emergency siren recognizes an attempted manipulation, it indicates this to the DWA by telegram regardless of whether the DWA K bus is affected.

Monitoring of the DWA K Bus

The DWA communicates with the emergency siren and the tilt sensor over the DWA K bus. Monitoring is started as soon as the DWA is armed.

The DWA sends the telegram to the Monitoring device cyclically (every 2 s) and expects a reply telegram from the emergency siren within a max. permissible reply time of 100 ms.

If the reply telegram is not received within this period of time, the telegram is sent to the monitoring device another two times. If the reply telegram is still not received after this, the DWA triggers an alarm using the Light Module and the vehicle horn.

DWA K-bus monitoring is deactivated when the DWA measures a vehicle voltage of 8.5 V.

DWA Alarm

If a triggering criterion is met when the DWA is armed, the alarm is generated both acoustically and visually.

Acoustic Alarm

After a triggering criteria is met, the DWA sends the telegram to the DWA K bus. The emergency siren acknowledges the alarm telegram.

If the DWA receives no confirmation from the SINE (siren), it repeats the alarm telegram up to 8 times. If it still receives no reply, the emergency operation horn (vehicle horn) is activated.

When the DWA is disarmed, the acoustic alarm is cancelled immediately and without acknowledgement.

Visual Alarm

The visual alarm is triggered at the same time as the acoustic alarm for a period of 5 minutes. The visual alarm is indicated by the hazard-warning lights flashing with the high beams.

This alarm cannot be extended by another trigger during the alarm cycle.

When the DWA is disarmed, the visual alarm is cancelled immediately and without acknowledgement.

Independent Alarm

If an attempt to manipulate one of the emergency siren wires is detected, an independent alarm is triggered by the siren.

If the DWA K bus is also disconnected, the interior sensor identifies this by the failure of the siren to reply and triggers a visual alarm.

Panic Alarm

The panic alarm allows the vehicle user to draw attention to a threat outside the vehicle or to an accident by generating an alarm.

The panic alarm can be activated by pressing the special panic function button on the Remote Control regardless of the state the DWA (armed/disarmed).



The alarm is not terminated by a time-out but can be stopped by pressing any button on the remote control. The alarm is not stored in the counter.

The DWA sends the alarm telegram every 33.5 s. When the panic alarm begins, the siren line monitoring function is started.

Monitoring takes place during the entire duration of the panic alarm. If a break in the wiring or a defect signal from the emergency siren is detected, the horn emergency operation function is activated.

The state of the DWA (armed/disarmed) is unaffected by the activation or the termination of the panic alarm. If a panic alarm is requested while a normal alarm is generated, the DWA immediately changes over to panic alarm mode. If an alarm trigger is detected while a panic alarm is generated, the panic alarm continues.

If the siren indicates a defect while an alarm is generated or if the DWA is unable to check the wiring to the siren, then the vehicle horn is activated.

On account of the time conditions which apply during line monitoring, a time delay of up to 2.3 s can occur.

An alarm activated for test purposes or by accident can be terminated by disarming the DWA or by generating the telegram "status_key_inserted". The alarm is aborted immediately. The abort is not acknowledged acoustically or visually.

The alarm memory of the USIS stores all alarms except the independent alarm. The alarm memory contains information on initial triggers, as well as subsequent triggers, date, time and environment related conditions (ambient temperature, window and sliding/tilt sunroof position, heating system etc.).

The alarm memory in the emergency siren stores only the data of the independent alarms. The last 5 alarms are stored.

Review Questions

1. Which component contains the master functions (logic) for the DWA system?

2. How does the DWA receive the request for arming and how does it receive the status of the alarm triggers? How is the emergency siren informed that the system is armed?

3. What is the effect that placing the hotel switch to “lock” has on the DWA?

4. What does the DWA do, if communication is no longer possible with the emergency siren?
