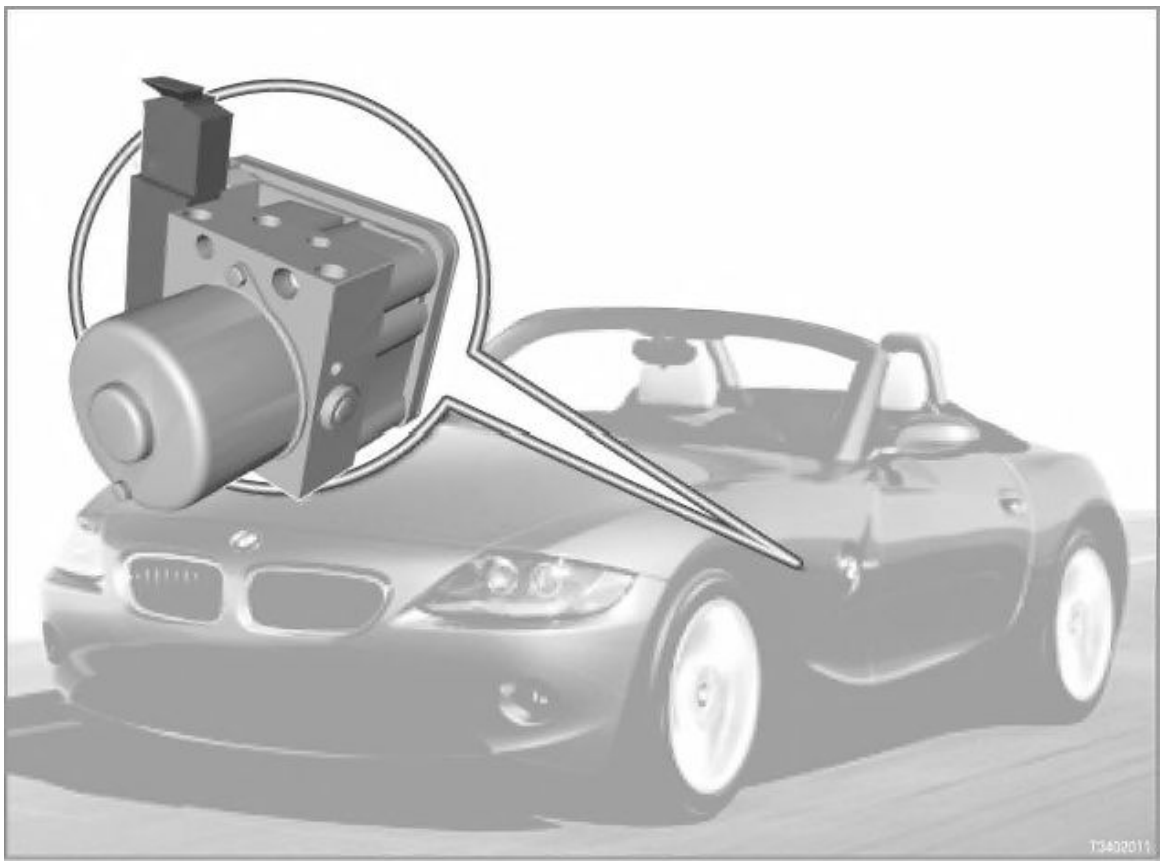
# Dynamic stability control DSC Mk60

E85



**Introduction**

The E85 is equipped as standard with dynamic stability control Mk60. DSC Mk60 was first introduced on the E46 in 09/2000, but without DTC function (DTC = dynamic traction control). From 09/2000 to 09/2001 DSC in the E46 was equipped with the ADB function (automatic differential brake). From 09/2001, DSC Mk60 has been available in the E46 with DTC function.
System supplier for DSC Mk60 is Continental Teves. [System overview ...]

DSC is a dynamic driving system that maintains driving stability.
DSC optimises:

- driving stability when pulling away, accelerating and braking
- traction

In addition, DSC recognises unstable driving situations such as understeering or oversteering. Within the limitations of the laws of physics, DSC helps to keep the vehicle on a safe course.
To do this, DSC must know the following parameters of driving dynamics:

- yaw rate as a measure of rotary movement of the vehicle around the vertical axis
- lateral acceleration as a measure of the coefficient of friction with the road surface
- road speed

In addition, the driver's requirements are recognised from the angle of the steering wheel and the pressure on the brake pedal. Moreover, speed sensors deliver information about the speed of each individual wheel. The actual situation in which the vehicle is currently moving is computed from the available data. The actual situation is compared to reference data computed by the DSC control unit.
If the actual data differ from the reference data, DSC is activated and intervenes in the braking system or in the engine control.

**The advantages:**
The active intervention of DSC in the engine control and brakes provides outstanding driving stability and traction

in all driving situations. DSC counters all negative dynamic driving forces and so creates a maximum degree of active safety within the limitations of the laws of physics. DSC thus enhances driving comfort by allowing more relaxed driving.

**Brief description of components**

Dynamic stability control DSC is comprised of the following components:

- **DSC hydraulic unit**

  The DSC hydraulic unit comprises the DSC control unit and hydraulic unit, and can be dismantled into these two components.

  The DSC control unit electronically actuates the hydraulic unit which in turn hydraulically controls the DSC. [more ...]

- **4 wheel speed sensors**

  The wheel speed sensors measure the speed of the individual wheels. [more ...]

- **DSC sensor**

  The DSC sensor measures the rotation of the vehicle around the vertical axis (yaw rate) and the lateral acceleration of the vehicle. [more ...]

- **Steering-angle sensor**

  The steering-angle sensor measures the angle of rotation of the steering wheel. [more ...]

- **2 brake pressure sensors**

  The two brake pressure sensors on the tandem-brake master cylinder measure the brake pressure generated by the driver (2nd brake pressure sensor as redundancy). [more ...]

- **DSC button**

  The DSC button is located on the centre console switch cluster and has 3 switch positions:

  DSC in standby, DTC in standby, DSC completely switched off.

Additional measured variables from the following components:

- **Brake fluid level switch** (via reed contact in expansion tank)

  Insufficient brake fluid is detected and a signal sent to the DSC control unit.

  DSC is deactivated if there is insufficient brake fluid. There would otherwise be a risk of air being drawn into the brake system.

  A signal is transmitted to the display in the instrument cluster via the CAN interface.

- **Brake light switch**

  Together with the signals from the brake pressure sensors on the brake master cylinder, braking actions are recognised.

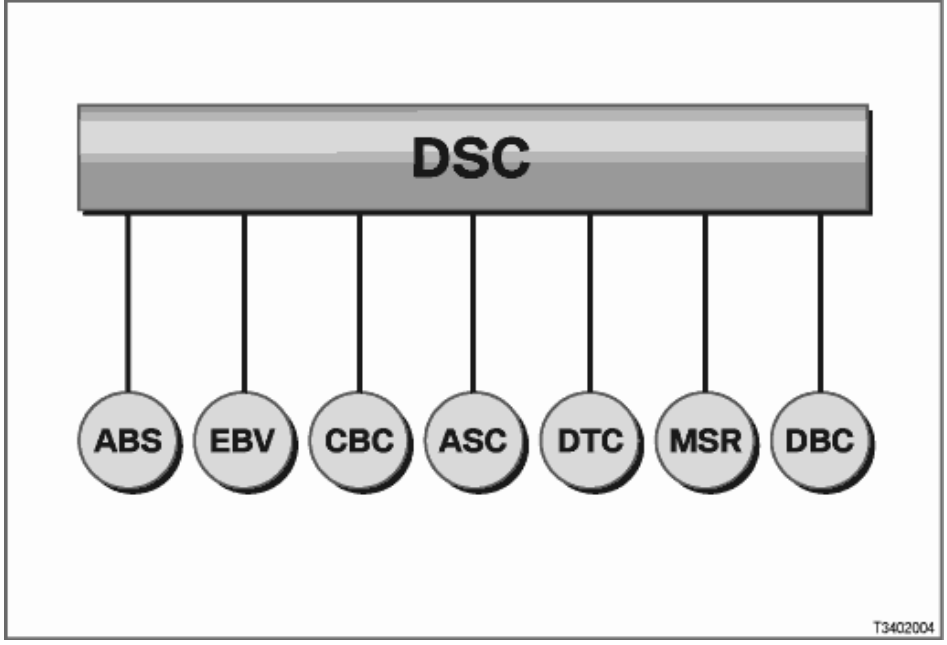
- **Parking brake warning switch**

  Skidding actions that are deliberately initiated by the driver are recognised by the DSC and **no** regulation takes place.

  Reason: a handbrake turn should remain technically possible.

**DSC system functions**

The DSC dynamic driving system is a lateral and transverse dynamic control system that actively intervenes in the actions of the brakes and engine control systems. DSC comprises a number of functions:

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|---|---|---|---|
| ABS | Anti-lock braking system | EBV | Electronic brake force distribution |
| CBC | Cornering brake control | ASC | Automatic stability control |
| DTC | Dynamic traction control | MSR | Engine drag torque control |
| DBC | Dynamic brake control | | |

**Anti-lock braking system ABS**

ABS prevents the wheels from locking when the brakes are applied.

Advantage: short braking distances, the vehicle remains stable.

Brake pressure is regulated at all wheels to ensure that each wheel runs in the best possible slip range. When this happens, slip is controlled so that the maximum possible braking and lateral stability forces can be transmitted.

**Electronic brake force distribution EBV**

EBV is a component of ABS and controls the brake force distribution between the front and rear wheels.

Advantage: regardless of the load state of the vehicle, the best possible braking distance is achieved while driving stability is maintained.

Modern vehicles have relatively large brakes on the rear axle to shorten braking distances. To prevent the rear wheels from being overbraked in certain driving situations, EBV permanently monitors the slip values. EBV controls rear axle slip in dependence of the front axle.

**Cornering brake control CBC**

CBC is an extension of ABS. CBC enhances driving stability if the brakes are applied when cornering.

Advantage: if the brakes are applied in a corner, optimum brake force distribution ensures the best possible tracking stability.

The shifting of wheel loads when cornering (even if brakes are only applied lightly) can adversely affect driving stability. If required, CBC generates a stabilising load moment when the brakes are applied lightly outside the ABS intervention range.

**Automatic stability control ASC**

ASC prevents the wheels from spinning when the vehicle is accelerating.

Advantage: enhanced traction and the vehicle remains stable.

If one of the wheels of the drive axle is on a high-grip surface and the other is on a slippery surface, the wheel tending to skid is braked.

ASC is also able to intervene in the engine control (to reduce the ignition angle, injection quantity, throttle valve setting).

**Dynamic traction control DTC**

The functions of the DTC correspond to those of DSC with a slightly modified regulating strategy. DTC can be activated by deactivating DSC (DSC button). DTC intervenes in the braking actions to imitate the function of a conventional differential lock.

Advantage: higher traction is available with DTC.

Vehicle stabilisation intervention (e.g. reduced power output) is made slightly later than with DSC. This enhances traction with a slight loss of driving stability. In particular when accelerating and driving uphill on a loose surface or in deep snow (coefficients of friction requiring increased slip), a compromise is needed between vehicle stability and traction: DSC provides a high degree of vehicle stability with adequate traction. DTC provides better traction with a slight loss of stability, and is thus only recommended in exceptional circumstances (e.g. when driving in deep snow).

**Engine drag torque control MSR**

Engine drag torque control MSR prevents: the tendency of the drive wheels to lock on a slippery surface when a lower gear is engaged or load is abruptly changed.

Advantage: the drive wheels retain their lateral stability in overrun mode.

The wheel speed sensors tell MSR as soon as the wheels are about to lock. MSR then briefly reduces the engine overrun torque by opening the throttle slightly.

**Dynamic brake control DBC**

DBC supports the driver in emergency braking situations by automatically boosting the brake pressure.

Advantage: shortest possible braking distances in emergency braking situations by achieving ABS regulation on all four wheels.

The brake pedal is frequently not depressed strongly enough in emergency braking situations. ABS regulation is then not activated.

The return pump increases the brake pressure until ABS regulation is activated:

- if the brake pedal is depressed quickly but with insufficient force (from brake pressure sensor signal)
- if the brake pedal is depressed slowly and then rapid deceleration is required (from brake pressure sensor signal), when one wheel reaches ABS regulation.

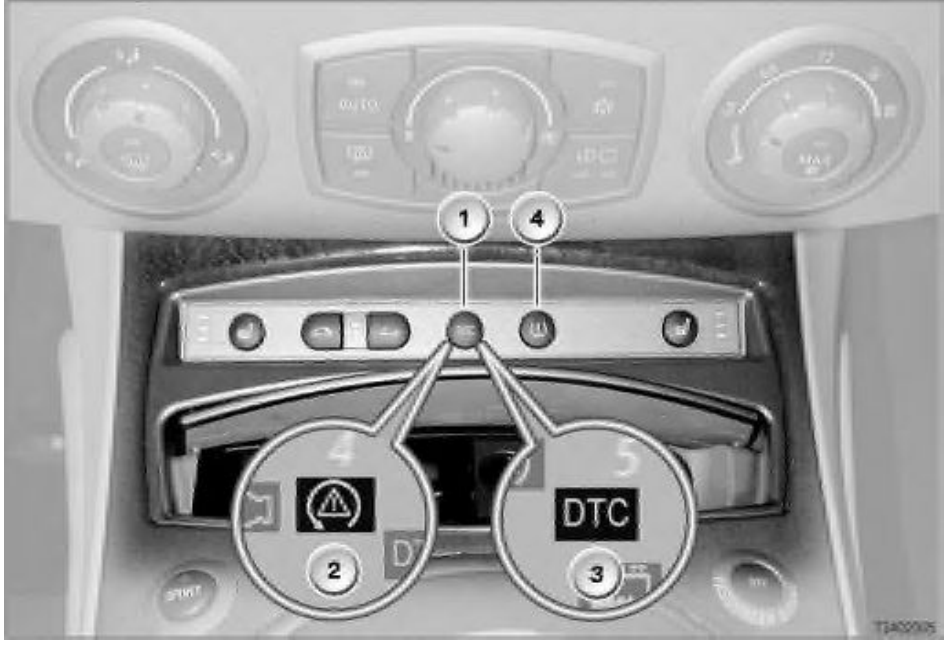
  Which wheel locks first depends on load and coefficient of friction of the road surface.

Example of a typical situation:

The traffic slows, making light braking necessary at first, but then demands as short a stopping distance as possible.

**Operation**

The DSC button is located next to the RPA button (RPA = tyre failure indicator) in the centre console switch cluster.




| Index | Explanation | Index | Explanation |
|---|---|---|---|
| 1 | DSC button | 2 | DSC indicator and warning light in instrument cluster |
| 3 | DTC indicator and warning light in instrument cluster | 4 | RPA button |

The DSC button has 2 functions that can be set by pressing the button for different lengths of time.

| Press button | Function | Remarks |
|---|---|---|
| short<br>< 3 seconds | DTC function activated. | DTC indicator and warning light on. |
| long<br>> 3 seconds | DSC is completely deactivated | DSC indicator and warning light on.<br>This mode is intended for service work (e.g. brake dynamometer). |

*Note: Reactivating DSC*

Pressing the button again reactivates the DSC function. The DSC indicator and warning light goes out (unless a fault has developed in the system).

The RPA button is used for initialisation (= learning tyre pressure) of the tyre failure indicator.
The tyre failure indicator is a function integrated into DSC (but not a dynamic driving function). Reason: the speed signals for all four wheels are already available in DSC.

**Preconditions for activation**

DSC is in standby after each engine start.

**Notes for service staff**

Service staff should not the following points:

- General information: [more ...]
- Diagnosis: ---
- Encoding/programming: [more ...]
- Car & Key Memory: ---

**US national version**

In US national version, 2 additional pins on the DSC control unit are assigned on vehicles **without navigation system**.
The following signals are then transmitted to the telephone control unit:

- processed wheel speed, front right
- processed wheel speed, front left

DSC tells the control unit the wheel speeds, front left and right.

**Advantage:**
Assume the vehicle is involved in a crash in a tunnel. The stored wheel speeds can be used to calculate the vehicle position (including cornering by left/right comparison).
The telephone control unit transmits the computed vehicle position in an emergency call.