SUBJECT: Electronic Damping Control (EDC III)

MODELS: E31, E32

Description: EDC III is a fully automatic adjusting damper control system which is a further refinement of earlier systems (EDC I & II) offered in markets other than the U.S. It also allows the driver the choice of two dampening programs, Comfort or Sport.

Conventional non-adjustable systems have damper (shock absorber) settings which provide an acceptable damping action over as wide a range of speeds and loads as possible. This means a compromise between comfortable softness and sportive hardness. Modern technology enables this tradeoff to be resolved with variable damping, and this principle has been adopted on the EDC III system.

The system uses various input parameters directly relating to road condition, load on the car and driving style to select one of three damping characteristics, (soft, medium or firm).

The result is optimum damping over a wide range of speeds and loads, and definite gains in both ride comfort and safety.

This is achieved by continuously matching the damping force to road conditions, vehicle load and driving style.

System Operation

The following inputs are used to detect dynamic forces acting on the

vehicle:

· Vertical acceleration
· Fore and aft acceleration
· Steering wheel angle
· Vehicle road speed
· Condition of road surface

There are three acceleration sensors: one each for the front and rear axles (vertical motion), and one for longitudinal motion. All three sensors are made from the same material and are solid state, piezo ceramic elements. Vehicle movement on the sensors is converted into an electric signal. The control unit uses these inputs to detect road surface condition, vehicle loading and degree of motion. The loading of the vehicle influences vertical motion and is therefore detected by the sensors.

The road speed input comes from the Electronic Body Module (EKM).

The steering angle sensor contains a potentiometer with two wipers which signal the control unit how far and how fast the steering wheel is turned.
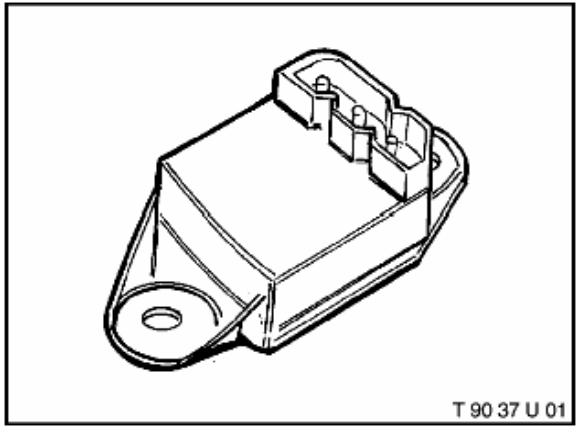
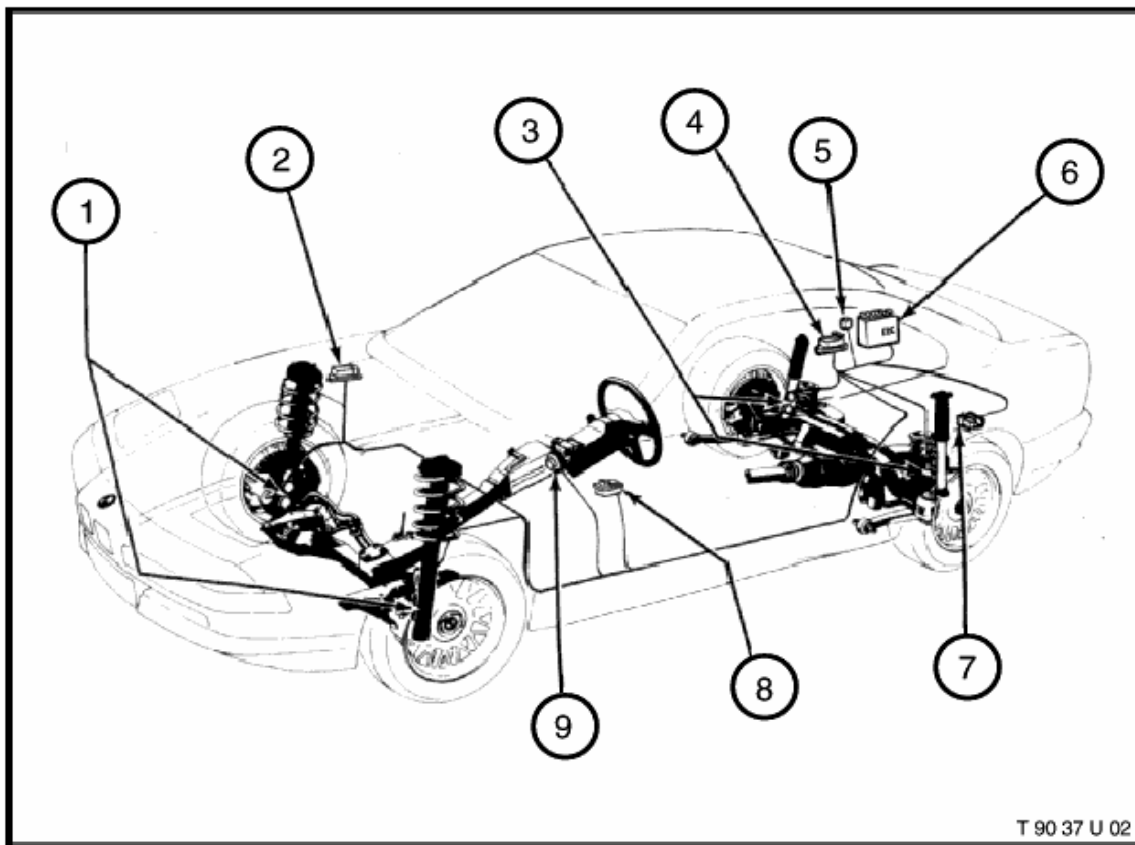
Motion Sensor
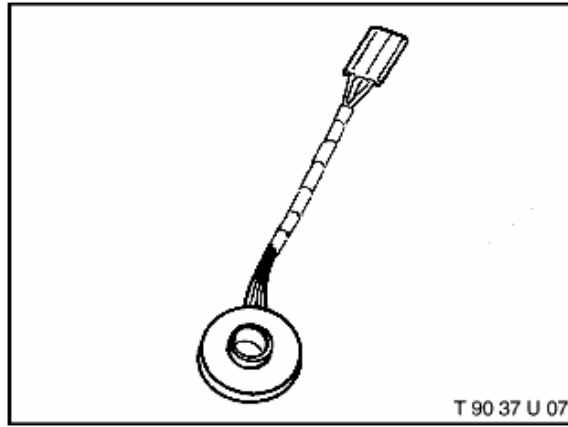
Steering Angle Sensor

The signals received from the sensors are processed by the control unit, which sends signals to solenoids on the front and rear shock absorbers. The system response can be varied by the driver by selecting the Sport (S) or the Comfort (K) position on the console mounted program switch.

Component Location

· **Front-axle vertical acceleration sensor** This is installed on the right side of the wheel housing, close to the right-hand upper spring strut mount, behind the splash guard.

· **Rear-axle vertical acceleration sensor** This is installed on the right rear wheel arch, on top of the spring strut mount.

· **Longitudinal acceleration sensor** On the left rear wheel arch, next to the car jack storage location.

· **Steering angle sensor** On the steering column (similar component for both the E31 and E32 but are not interchangeable).

· **Solenoid valves** Two valves are mounted at the base of each strut assembly.

· **Program switch** located on center console.

· **EDC III control unit and power relay** Both units are mounted in trunk on right side.

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1   Front Solenoid Valves
2   Front Vertical Acceleration Motion Sensor
3   Rear Solenoid Valves
4   Rear Vertical Acceleration Motion Sensor
5   EDC Power Relay
6   EDC III Control Unit
7   Longitundinal Acceleration Sensor
8   Program Switch
9   Steering Angle Sensor

Damper (Shock Absorber) Operation

The dampers used on the EDC III system are similar to conventional twin tube dampers, but have two solenoid valves on each damper. These valves provide an additional passage for oil flow in the soft and medium modes of operation.

When the solenoids are de-energized, the damping valves are held closed by spring pressure. This represents the firm setting with oil flowing through the piston and base valves. One of the damping valves is energized for the soft setting and the second valve is energized for the medium setting.

Both valves are never energized simultaneously. Damping can be varied front to rear, but not side to side.
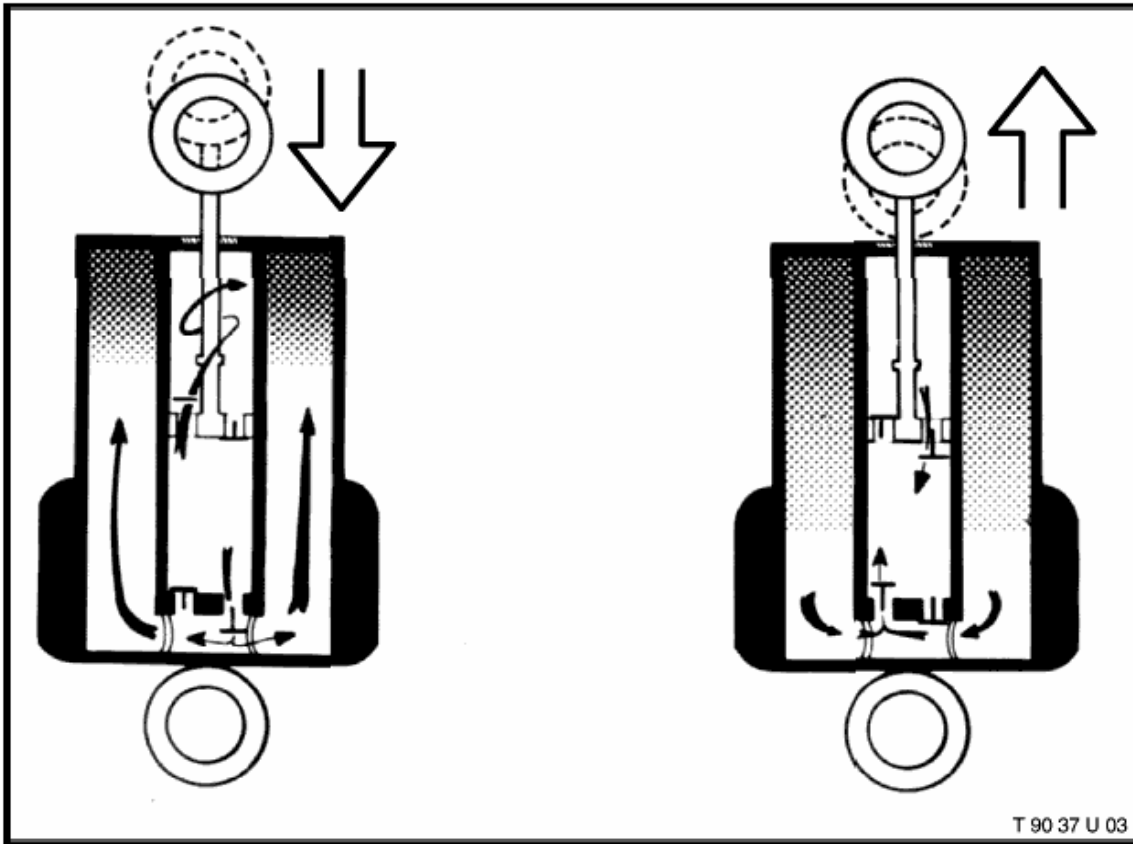
Shown below is a basic gas-charged damper. When the vehicle bounces, the damper travels thru the compression and rebound stages.

The damper, as illustrated, corresponds to the EDC III firm damper setting because the oil

transfer uses only mechanical one-way valves.

Compression Stage   **Rebound Stage**

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The EDC III system can provide softer damping rates (soft, medium) by energizing solenoid valves which allow additional oil volume to be transferred.

The EDC III solenoid operation is identical for both soft and medium settings. The soft solenoid has a larger orifice so more oil can pass through the energized solenoid.
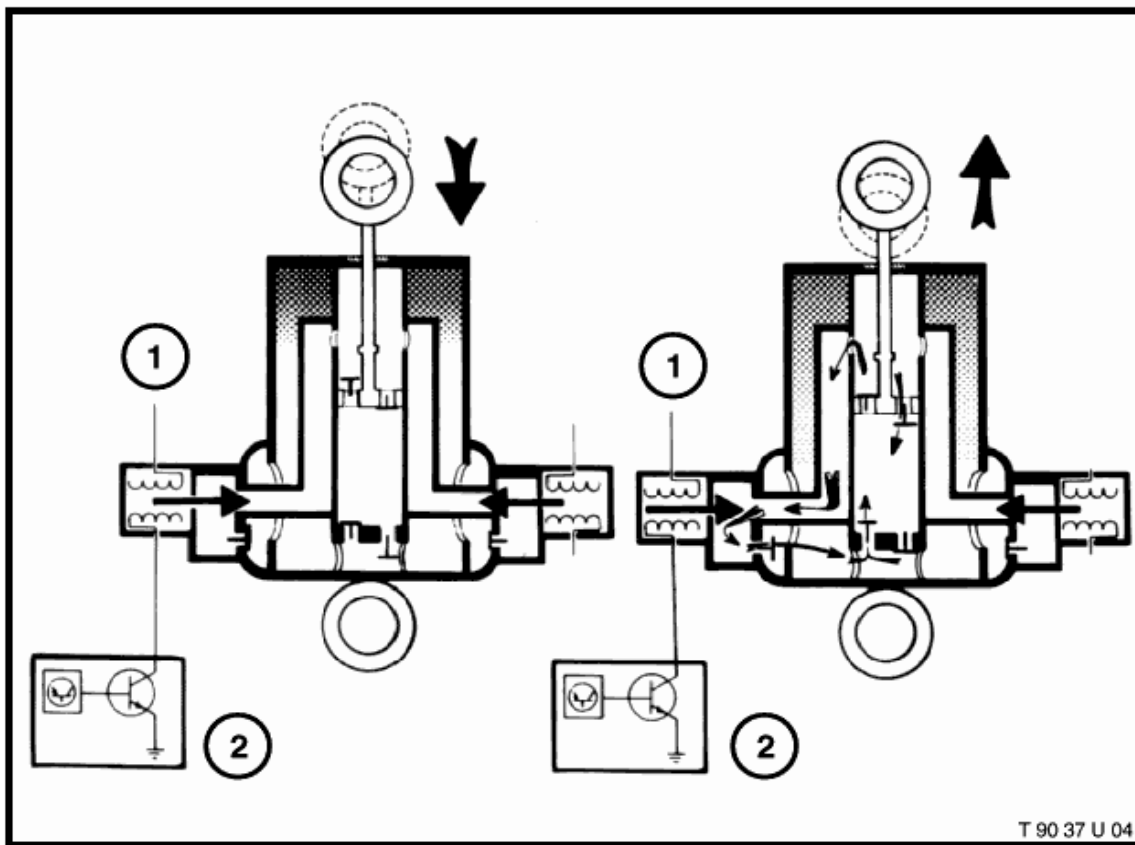
Soft Setting =   Soft solenoid energized =   Maximum oil transfer

Medium =   Medium solenoid = Moderate oil transfer
Setting   energized

Firm Setting =   No solenoids energized =   No oil transfer
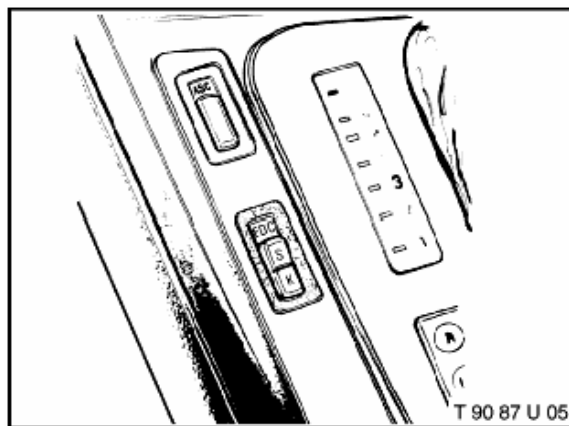
Compression Stage   **Rebound stage**

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1   Power

2   EDC III Power Control Unit

Program Selection

The two-position console mounted switch enables the driver to choose between the Comfort (K) program and the Sport (S) program. The only indication of program selection is the switch position.


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Comfort Program

When the comfort program is selected, the priority setting is for soft damping. Any changes to dynamic movement detected by the sensors will allow the system to switch to either medium or firm depending on how severe the dynamic changes are. The system will automatically switch back to the soft setting when conditions warrant. This results in an ideal combination of maximum comfort and optimum driving responsiveness.

Sport Program

When the sport program is selected, only the medium and firm damping settings are used. The control unit selects the medium setting until dynamic changes require a higher damping force to maintain stability. The program characteristics allow the firm setting to be selected sooner and held longer than the comfort program.

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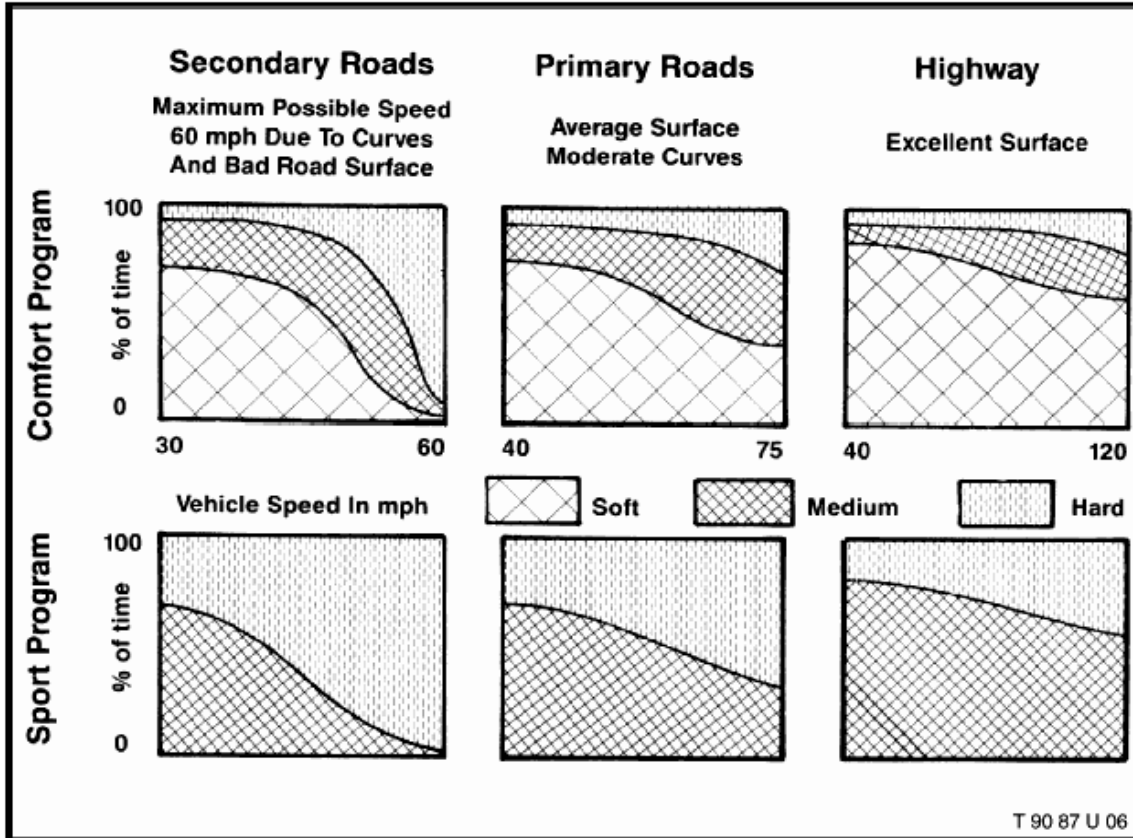
System Monitoring

All operating cycles and sensor inputs are checked by the control unit for plausibility and function. Any faults that might occur are stored in a defect memory according to their priority.

In the event of certain faults, the control unit selects the "medium" damping setting.

The following faults will cause the control unit to select the medium setting:

· Steering angle sensor
   e.g. bent wiper in sensor (signals do no match; max. deviation 30°)
   or temporary signal disturbance

· Steering angle sensor
   e.g. contact difficulties, wiper on conductor of potentiometer, loose
   contact in connector

· Steering angle sensor
   e.g. broken locating pin (sensor always supplies same signal),
   steering angle sensor not fitted

SBT EDC III
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· Defect in road speed signal

  e.g. no V-signal in the case of break in wire to EKM

· Defect-vertical acceleration front axle

  e.g. signals not within working range (defective sensor)

· Defect-vertical acceleration rear axle

  e.g. signals not within working range (defective sensor)

· Defect-longitudinal acceleration

  e.g. signals not within working range (defective sensor)

If the soft solenoid valve circuit fails, the medium setting is selected.

If the medium solenoid valve circuit or control unit fails, the solenoids are de-engerized which results in the firm setting.

Note: In case of a system failure where the system goes into a
       firm setting, there is no visual warning to the driver of a
       system problem. The only indication is that the ride is firm
       at all times.

Diagnosis/Troubleshooting

The EDC III is connected to the diagnostic link. Any faults stored in memory can be read out with the Diagnostic Module. Troubleshooting is carried out as with other systems by following procedures listed on the service tester display screen and using the ETM and Diagnostic Manual. After connection to the Diagnostic Module the control unit identification is displayed, followed by the selection list.

1. Read defect code memory
2. Monitor status
3. Actuate components
4. Test procedure
5. Special functions
6. Test code
7. Clear defect code memory