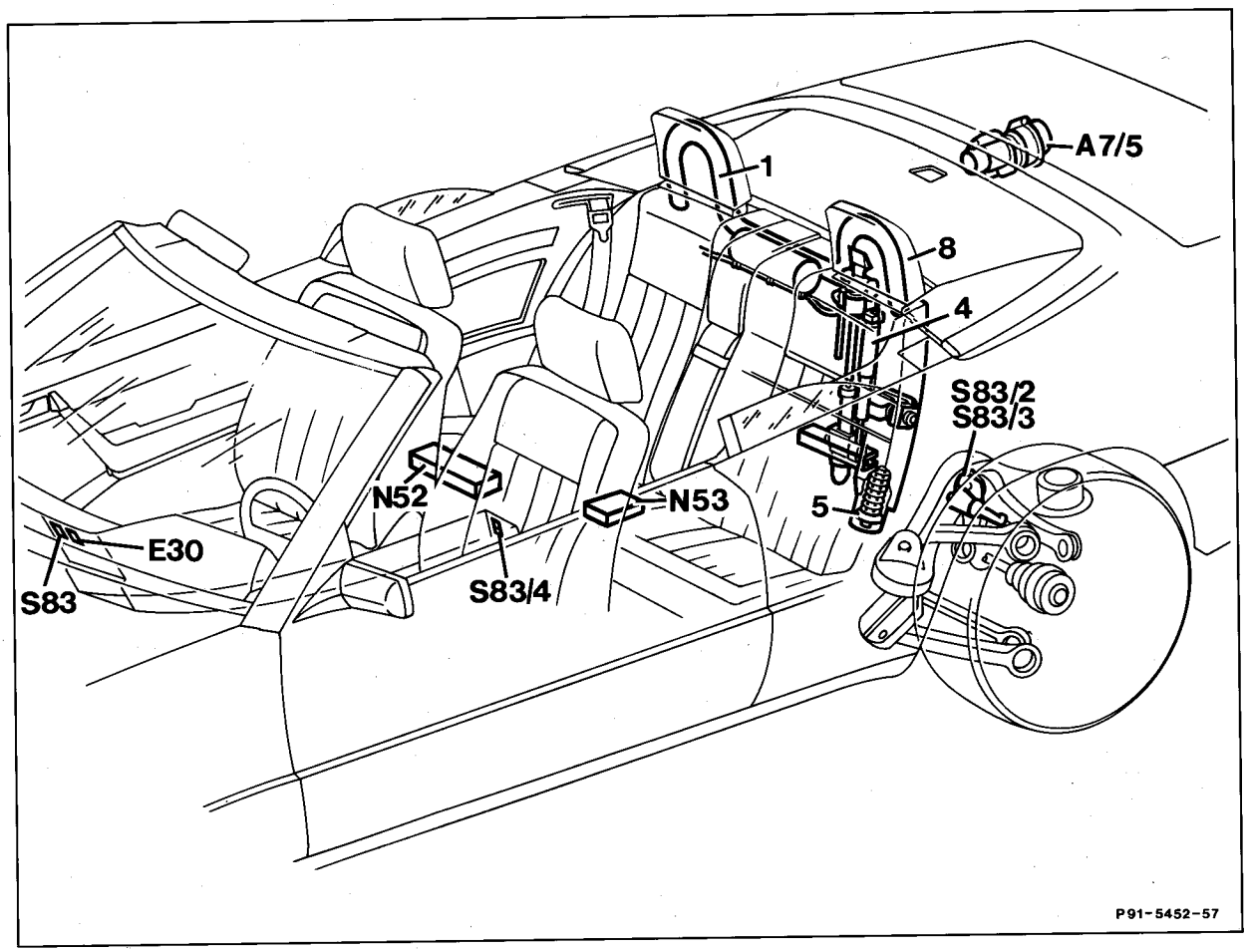


Roll-over bar system, model 124.061

A7/5	Roll-over bar (ÜRB)/soft top operation hydraulic unit	1	Roll-over bar integrated into head restraint
E30	Roll-over bar indicator lamp, center console	4	Support and actuating element
N52	Soft top control unit	5	Left and right springs (crash actuation)
N53	Roll-over bar (ÜRB) crash sensor control unit	8	Head restraint
S83	Roll-over bar (ÜRB) convenience switch		
S83/2	Left rear axle switch, roll-over bar (ÜRB)		
S83/3	Right rear axle switch, roll-over bar (ÜRB)		
S83/4	Roll-over bar switch		

A. Roll-over bar

The roll-over bar (1) consists of high tensile strength tubular steel bent in a U-shape integrated into the head restraints (8) on both sides and recessed behind the rear seats. The roll-over bar is extended during an accident or in critical situations by the roll-over bar control unit. The vehicle acceleration and vehicle inclination signals are evaluated in the processor and compared with the set values. If the processor recognizes a vehicle acceleration > 0.4 g (1 g ≈ 9.81 m/s^2) or a vehicle inclination > 22° or lateral acceleration > 0.4 g and at least one open rear axle switch, the rollover output stage is actuated (crash actuation).
The roll-over bar can also be extended manually (convenience feature) with switches in the front and rear center consoles. This is also possible with the top closed and while driving.

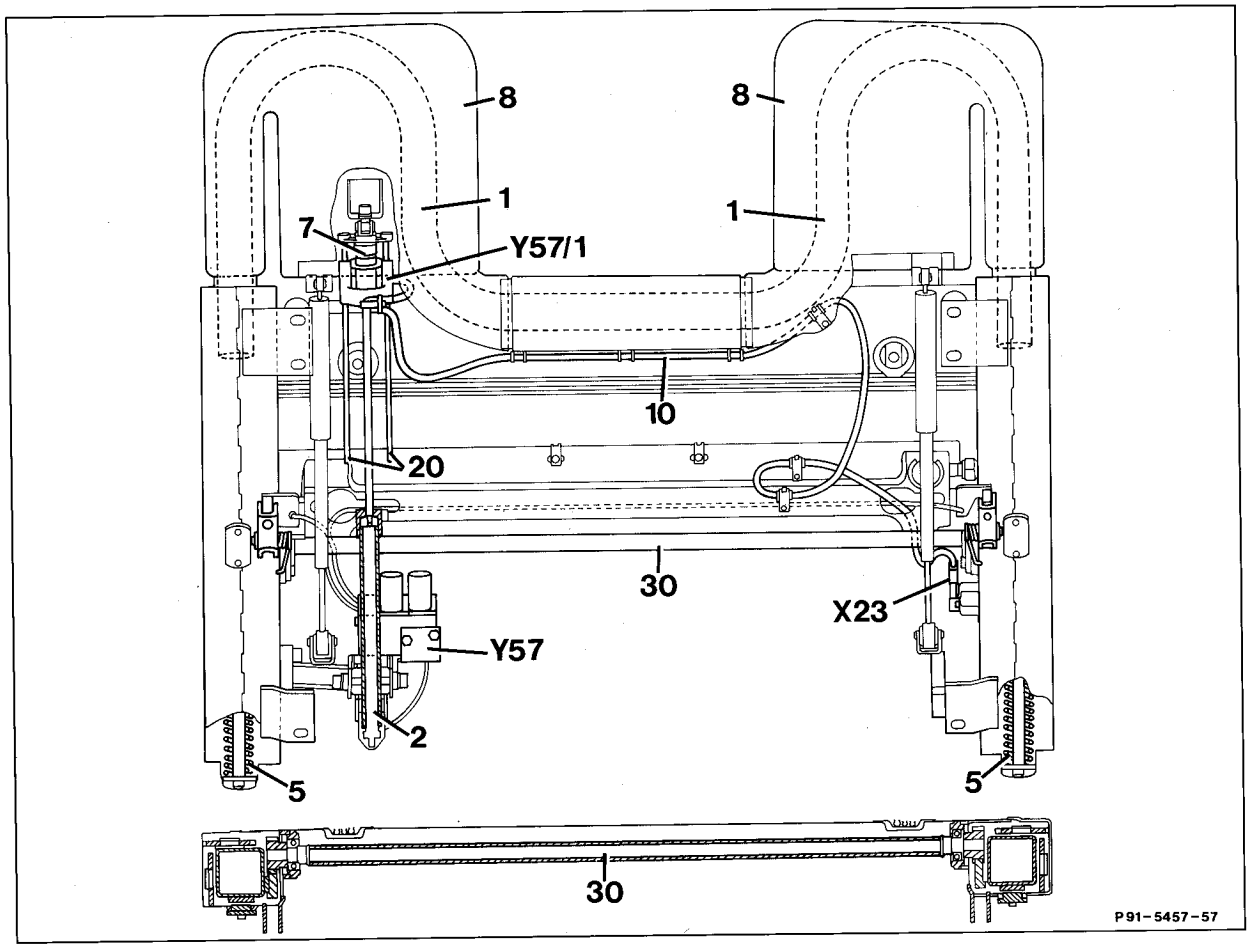
The roll-over bar moves along a slightly curved path guided in the vertical direction by rollers when it extends and retracts.

To prevent the roll-over bar from canting while extending or retracting, a synchronization shaft (30) is present which runs in teeth driven by a pinion on both sides.

The roll-over bar system consists primarily of the following components and assemblies:

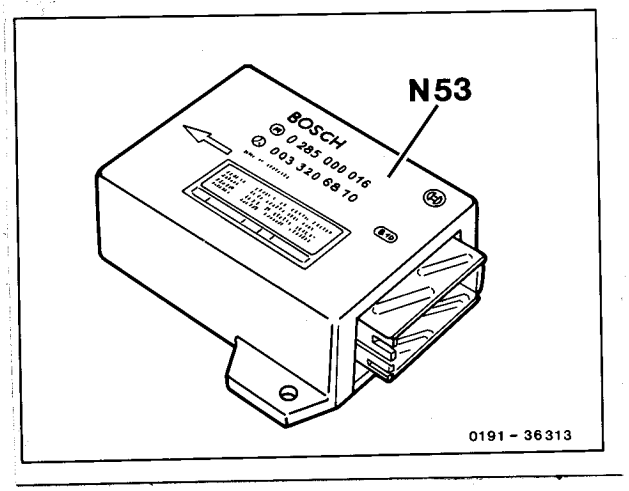
- Roll-over bar
- Control unit
- Triggering solenoid
- Roll-over bar actuation switch (convenience feature)
- Indicator lamp
- Rear axle switches
- Support and actuating elements

- Hydraulic unit
- Roll-over bar valve block
- Soft top control unit



B. Control unit (N53)

The roll-over bar control unit is located on the tunnel below the rear seat.
The control unit contains two piezo-electric sensors for sensing the vehicle acceleration in the longitudinal (X) and lateral (Y) directions. A piezo-ceramic bender bar mounted in and damped by a sensor is bent by negative acceleration, e.g. accident, braking, due to its inertia of rest, producing a voltage. This voltage serves for measurement of the acceleration. Its location in the control unit corresponds to this function (90° angle).



The signals from the sensor elements are mathematically processed, whereby a constant acceleration sensitivity is achieved in any desired direction in the horizontal plane. A position switch measures the vehicle inclination (all the way around).

All of the signal conversion and processing is accomplished digitally.

The electronic control unit is subdivided functionally into:

- Acceleration sensors (X and Y)
- Signal conversion stage
- Microprocessor
- Output stages
- Monitoring
- Fault memory

Signal conversion stage
In the signal conversion stage the input signals from the rear axle switches are converted into a form suitable for the processor.

Processor
The vehicle acceleration and inclination signals are evaluated in the processor and compared with the set values. If the processor recognizes a vehicle acceleration > 0.4 g or vehicle inclination > 22° or lateral acceleration > 0.4 g and at least one open rear axle switch, the roll-over bar output stage is actuated.

Output stages
When the control unit recognizes a fault the indicator light receives power from the corresponding output stage.
If the control unit recognizes an accident or critical situation, the roll-over bar output stage is actuated and the roll-over bar extended.

The roll-over bar control unit and soft top control unit are connected by a data bus (2 lines) for exchange of the following information:

- Roll-over bar okay
- Roll-over bar defective
- Vehicle acceleration > 0.4 g
- Crash actuation

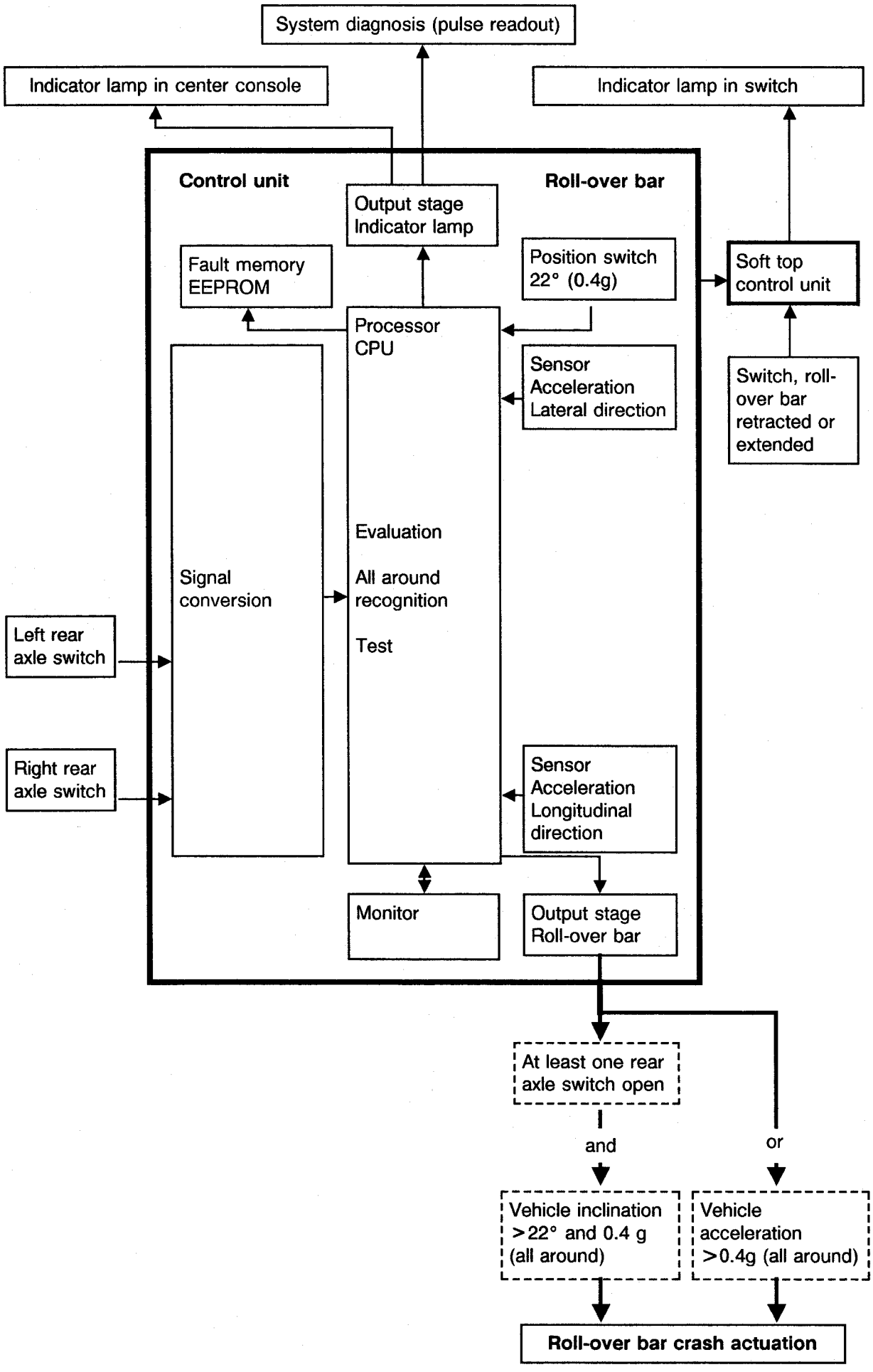
The processor itself as well as all electronic components located outside are monitored. Upon recognition a fault is indicated by the indicator lamp in the center console coming on. Simultaneously two LED's in the roll-over bar switch (convenience feature) come on. This serves as a request to put up the roll-over bar.

Fault memory
The following faults are recognized and stored in a non-volatile memory (EEROM).

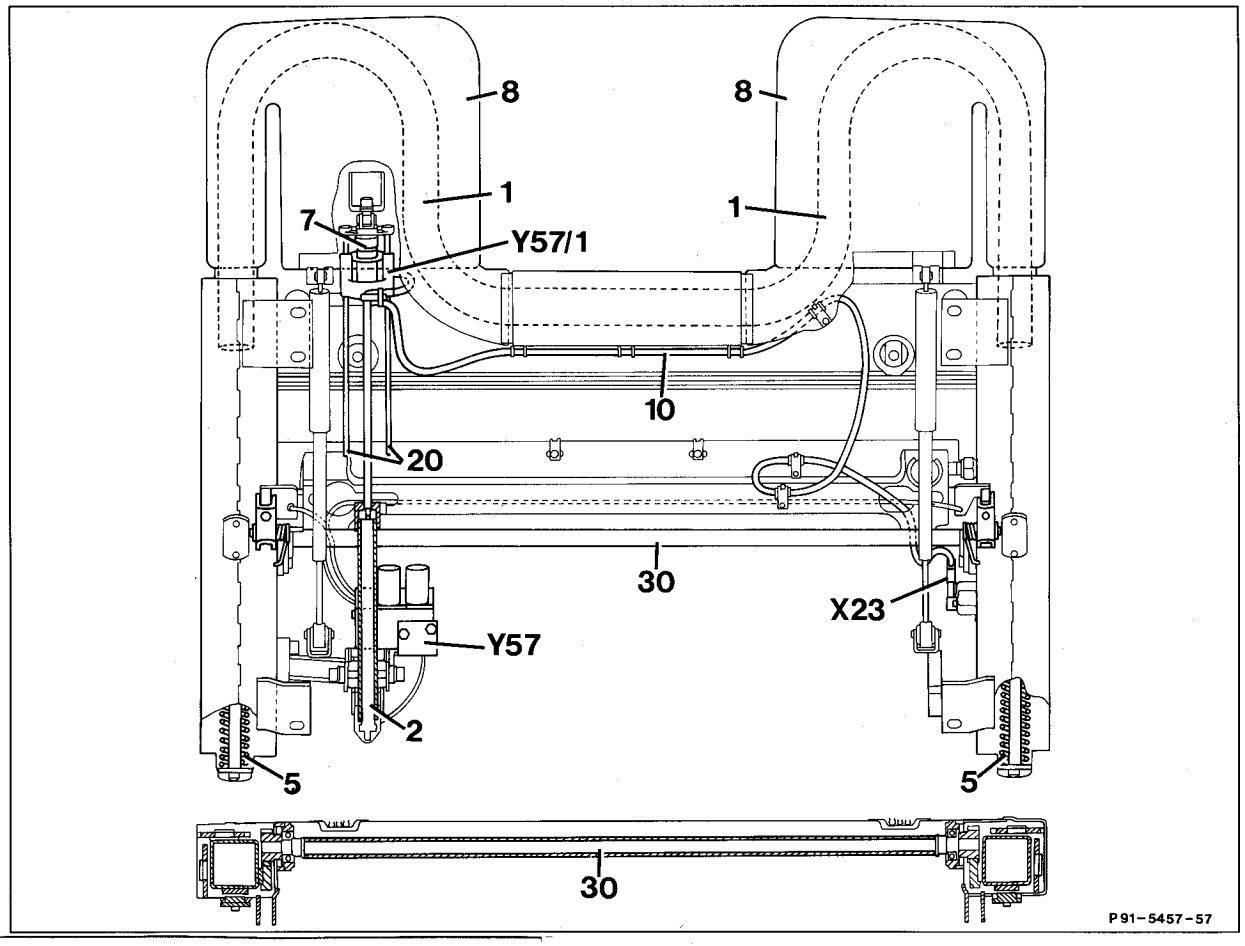
- Control unit defective
- Voltage too low
- Roll-over bar triggering solenoid defective
- Rear axle switch (short circuit to positive or ground)
- Indicator lamp

The stored faults can be read out via pulse readout on the test connector for diagnosis.

Block diagram, roll-over bar total function



C. Roll-over bar triggering solenoid (Y57/1)

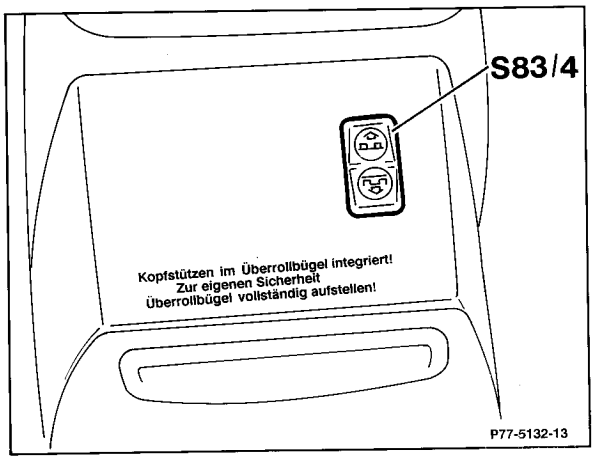


Y57/1	Roll-over bar (ÜRB) triggering solenoid
2	Support and actuating element
5	Spring (crash actuation)
7	Lock

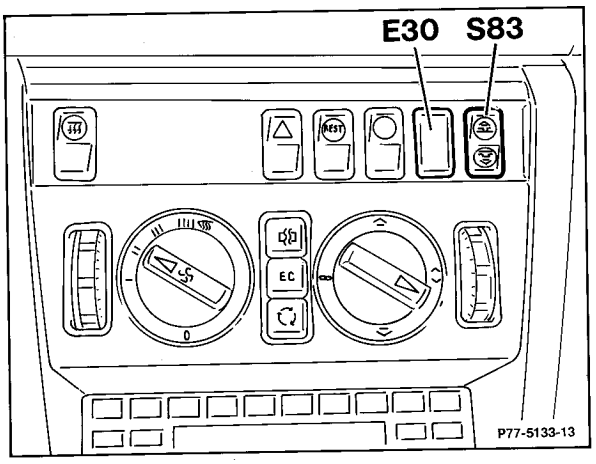
The roll-over bar triggering solenoid (Y57/1) is located on the left support and actuating element (2). In an accident or a critical situation it is actuated by the roll-over bar control unit. This opens the lock (7), which holds the roll-over bar in the stored position. The roll-over bar is extended by pretensioned springs (5).

D. Roll-over bar convenience switch (S83), (S83/4)

The roll-over bar can also be extended and retracted while driving with the so-called convenience actuation feature with the switch (S83) or (S83/4) in the center console. This is also possible with the soft top open or closed. The convenience actuation feature is inhibited while the soft top is moving. In the event of a defect in the roll-over bar system the two LED's in the shape of two triangles pointing upward in switch (S83) or (S83/4) flash. This serves to tell the driver to extend the roll-over bar with the convenience actuation feature to ensure protection in the event of an accident or critical situation. The LED's also flash when the rollover is not completely extended or retracted.



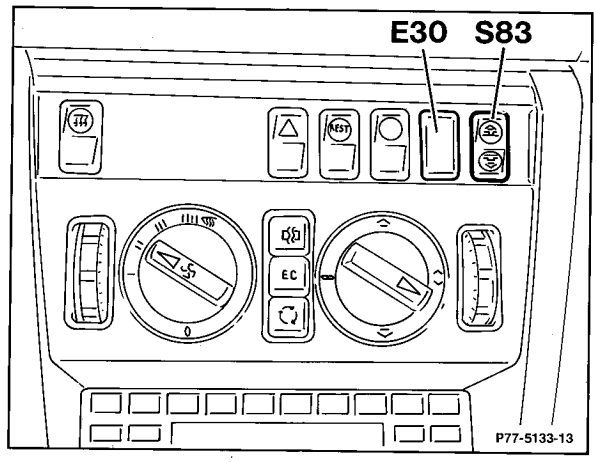
The roll-over bar is automatically retracted while the soft top is in motion to avoid a collision between the roll-over bar and soft top (roll-over bar extended). The roll-over bar is extended again after actuation of the soft top has been completed. The convenience actuations also serve for retracting the roll-over bar after a crash actuation (see control unit for crash actuation). For this purpose it is necessary to press switch (S83) or (S83/4) up in the extend direction for approx. 5 s until the lock has engaged audibly. This causes the hydraulic cylinder to move up and the lock to engage. Retraction is then possible. Switch S83/4 can be inhibited by the safety switch for the rear window lift (child safety lock).



E. Roll-over bar indicator lamp (E30)

The indicator lamp (E30) is located in the center console at the top right. When the ignition/starter switch is in position two, the indicator lamp comes on and goes off again when the engine is running as long as a fault is not present.
If the indicator lamp comes on with the engine running, a fault is present. The fault can be read out via the pulse readout function.

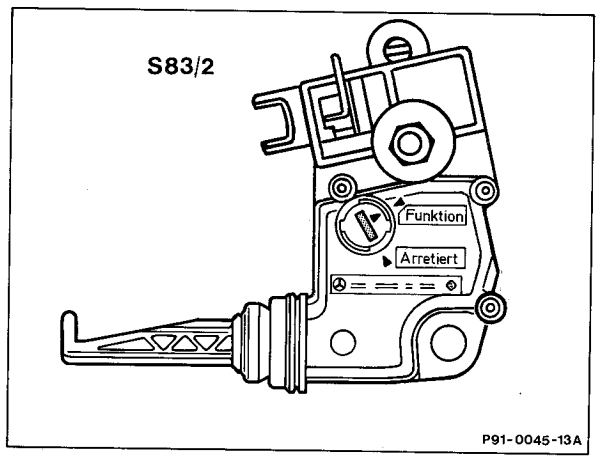
See Diagnosis Manual, Body, Volume 2 for pulse readout.



F. Rear axle switches for roll-over bar (S83/2, S83/3)

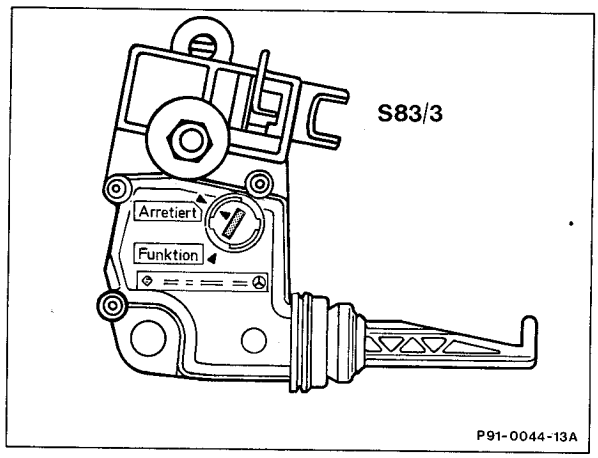
The rear axle switches are located on the left and right sides on the rear axle spring links for measurement of critical situations, which could lead to the car rolling over (e.g. rear axle suspension fully extended). They are designed as normally closed switches.

The rear axle switches have two positions each labeled:



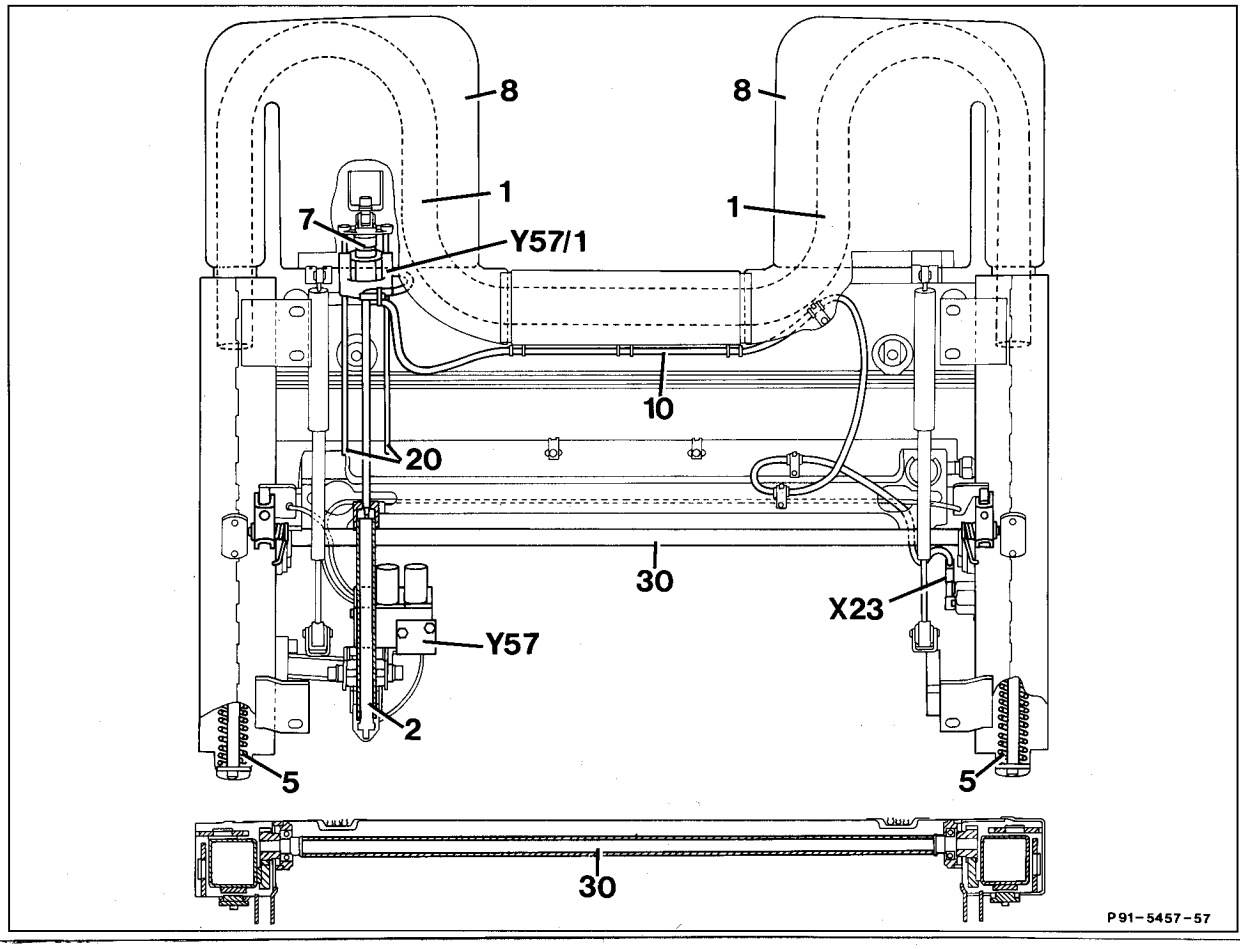
Funktion (function)
In this position the rear axle switch is ready for operation (movable).

Arretiert (arrested)
In this position the rear axle switch is open and mechanically arrested. This position is required for adjustment of the rear axle switches.

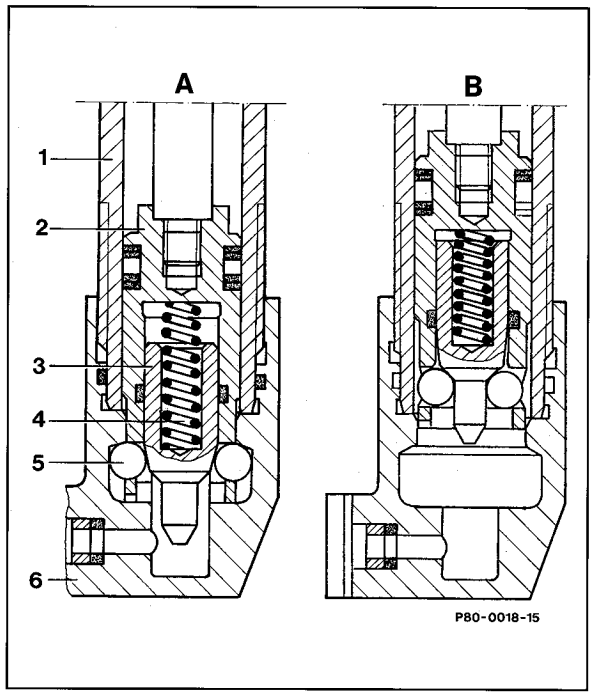


G. Supporting and actuating elements

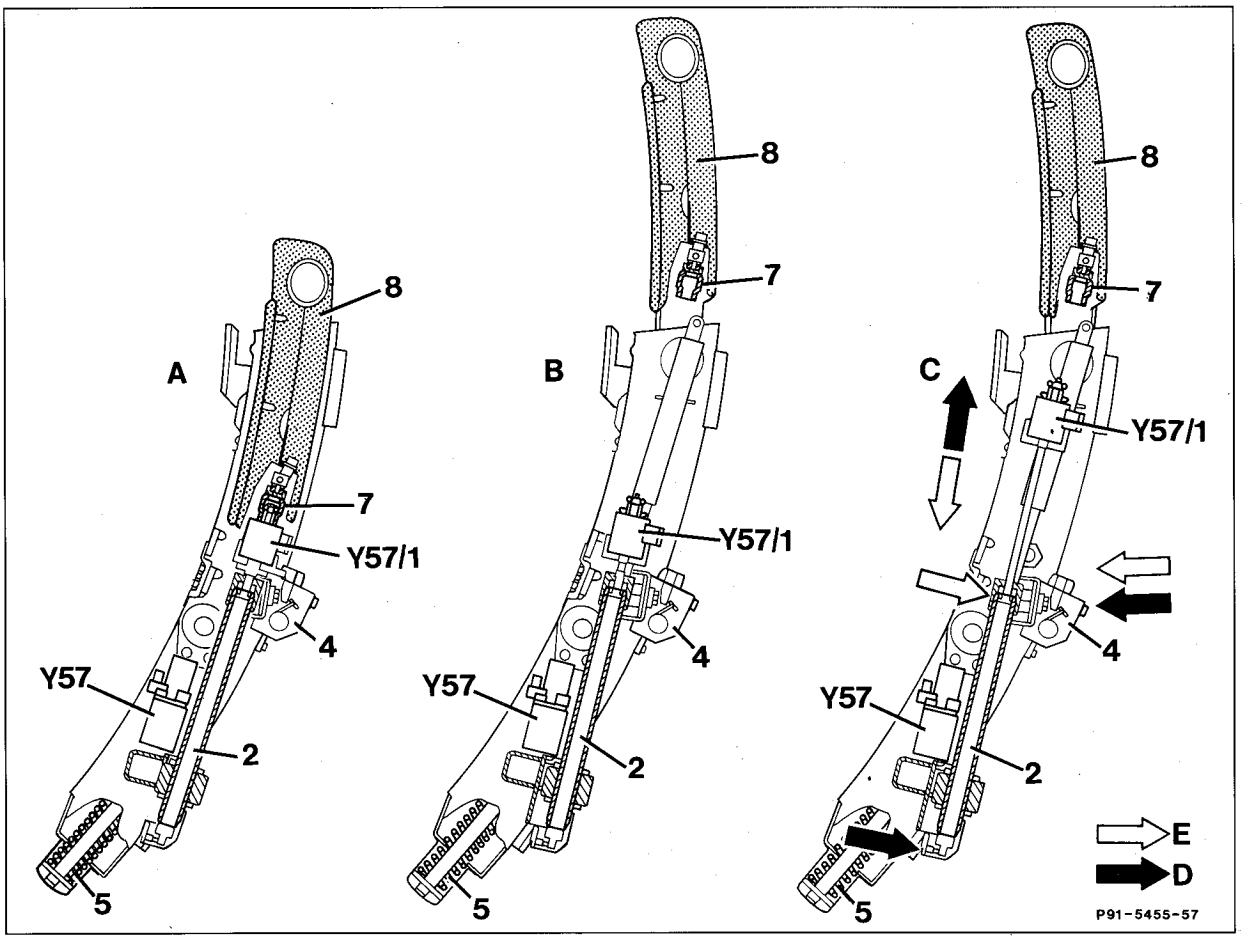
The roll-over bar is driven on the left side by a hydraulic cylinder on the supporting and actuating element (2).
The pressure is supplied by a hydraulic unit located in the right trunk recess. The corresponding solenoid valve on the roll-over bar valve block (Y57) is actuated by the soft top control unit for extending and retracting the roll-over bar (8).



Mechanical interlock of actuating element
Since the hydraulic circuit is not under pressure when the convenience actuation feature is not in operation, the piston for the actuating element must be locked mechanically in the bottom position (A). It is locked by the spring force (4) acting on the balls (5). When the convenience actuation feature is operated the interlocking piston (3) and piston (2) receive pressure acting against the spring force. This releases the lock (B).



Crash actuation

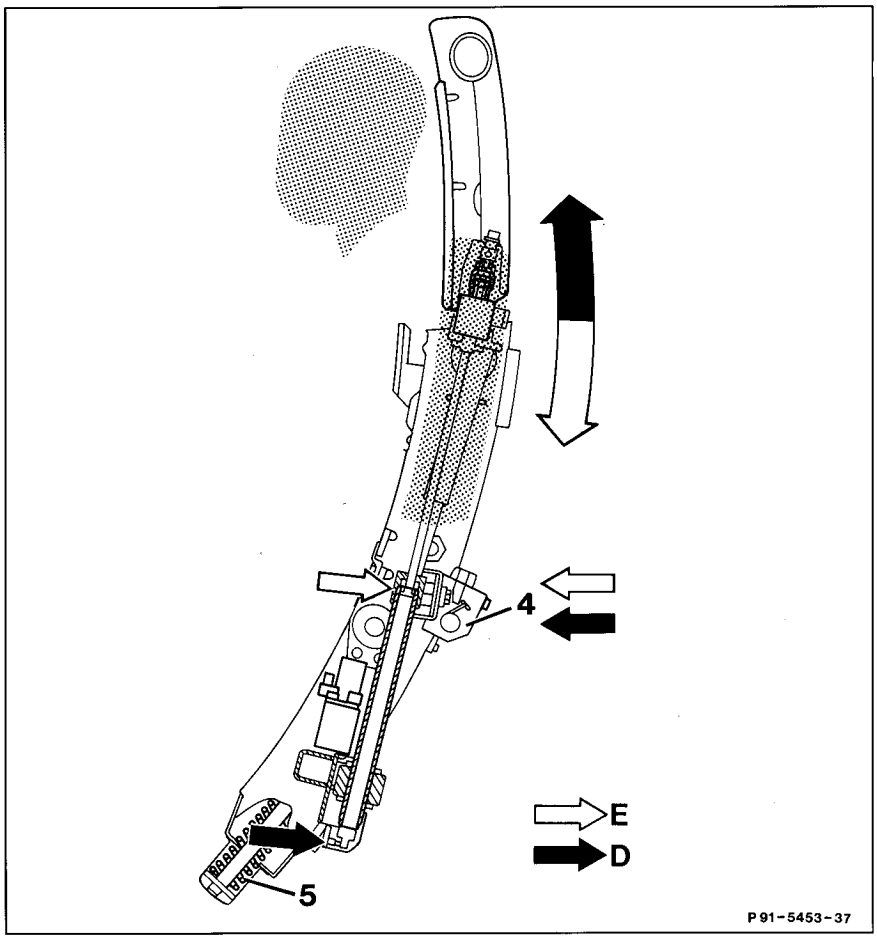


Y57	Valve block, roll-over bar (ÜRB)	2	Supporting and actuating element
Y57/1	Roll-over bar (ÜRB) triggering solenoid	4	Locking pawl
A	Roll-over bar retracted	5	Spring (crash actuation)
B	Roll-over bar crash actuation	7	Connector (triggering solenoid)
C	Roll-over bar retracted following crash actuation	8	Head restraint
D	Hydraulic system under pressure (extend)		
E	Hydraulic system under pressure (retract)		

In the stored position (A) the supporting and actuating element (2) is held in place by the lock (7) and the roll-over bar triggering solenoid (Y57/1). If the triggering solenoid (Y57/1) is tripped by the control unit (ground signal), the lock (7) opens and the head restraints (8) are extended within approx. 0.3 s (B) by the pretensioned springs (5).

This procedure is accompanied by a chattering noise, because the locking pawl (4) engages in the rack during the extension operation.
This ensures that the roll-over bar will be locked even when loaded prematurely.

To retract the roll-over bar following a crash actuation (C) it is necessary to actuate the roll-over bar convenience switch (S83, or S83/4) for approx. 5 s in the direction extend.
This causes the supporting and actuating element (2) to be put under pressure by the roll-over bar valve block (Y57) moving the triggering solenoid (Y57/1) up to engage with the lock (7).
The roll-over bar can then be retracted.



4	Locking pawl
5	Spring (crash actuation)
D	Hydraulic system under pressure (extend)
E	Hydraulic system under pressure (retract)

Convenience feature

The convenience actuation feature puts the hydraulic element under pressure on the piston side (arrow D) to extend the roll-over bar and on the rod side (arrow E) to retract the roll-over bar. This releases the tension on the spring (5) or retensions the spring respectively.

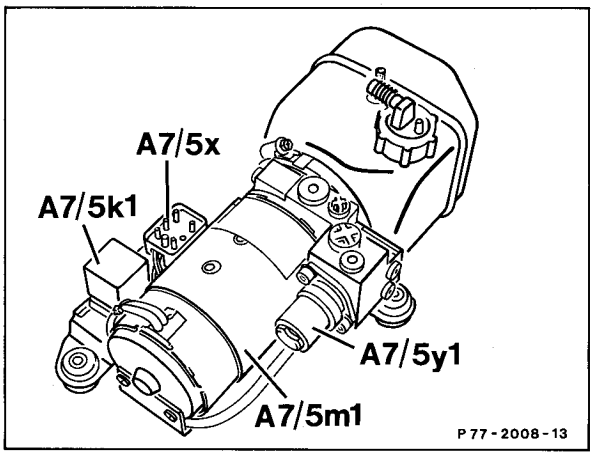
The extension speed as well as the extension force (resulting from the spring force and hydraulic force) of the roll-over bar are controlled by a restrictor in the actuating element or by dampers. In order to avoid noises when the roll-over bar extends (locking pawl - rack) the spring loaded locking pawls (4) on both sides are supplied with pressure by a hydraulic servo-cylinder and pivoted away from the rack.

Crash actuation has priority over convenience actuation, i.e. the triggering solenoid can be actuated even during convenience actuation. For this purpose the pressure to the servo-cylinders is released and the locking pawls (4) pivot into the rack, the roll-over bar is extended by the spring force (5).

See table for retraction of roll-over bar following crash actuation.

H. Hydraulic unit

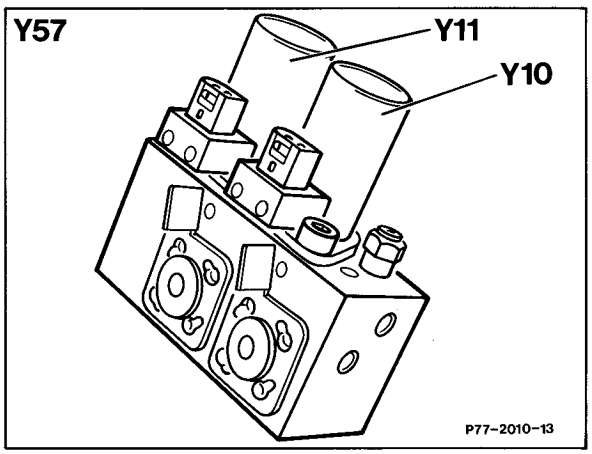
The hydraulic unit (pump, motor, supply reservoir) is located in the right trunk recess. When the roll-over bar convenience actuation switch or the soft top actuation switch is pressed, the pump (A7/5) runs as long as the switch is pressed supplying a pressure of approx. 180 + 10 bar. This pressure is limited to 180 bar by a pressure limitation valve. The roll-over bar hydraulic circuit is supplied directly by the pump upstream of the main valve (A7/5y1).



I. Valve block, roll-over bar (Y57)

The roll-over bar valve block is located on the left behind the rear seat backrest. The solenoid valves are actuated by the soft top control unit when the soft top actuation switch is pressed.

Solenoid valve (Y11) extend roll-over bar.
Solenoid valve (Y10) retract roll-over bar.
During this operation pressure is supplied to the locking pawl pivoting it away from the rack.



J. Information from roll-over bar control unit to soft top control unit

The roll-over bar control unit is responsible for crash actuation, the soft top control unit for the convenience actuation feature. Both units are connected with one another by means of two lines. The following information is transferred:

a) Roll-over bar okay
b) Roll-over bar defective
c) Vehicle acceleration > 0.4 g
d) Crash actuation

Explanations on b, c and d:

b) If the roll-over bar control unit recognizes a defect (indicator lamp for roll-over bar in center console comes on), the soft top control unit checks the roll-over bar limit switches (extended/retracted). If the roll-over bar is retracted (limit switch retracted switched), the soft top control unit intermittently actuates the LED's in the switches for the convenience feature. This serves as a request to extend the roll-over bar. When the roll-over bar is extended, the LED's go off.

c) This signal serves as an additional check for the speed signals (ABS, ASR). Actuation of the soft top is inhibited when correct speed signals are not present.

d) If the soft top control unit receives a crash signal from the roll-over bar control unit, the pressure/power to the hydraulic system is switched off immediately if the soft top or roll-over bar is presently in operation.

K. Function of crash actuation and retraction following crash actuation

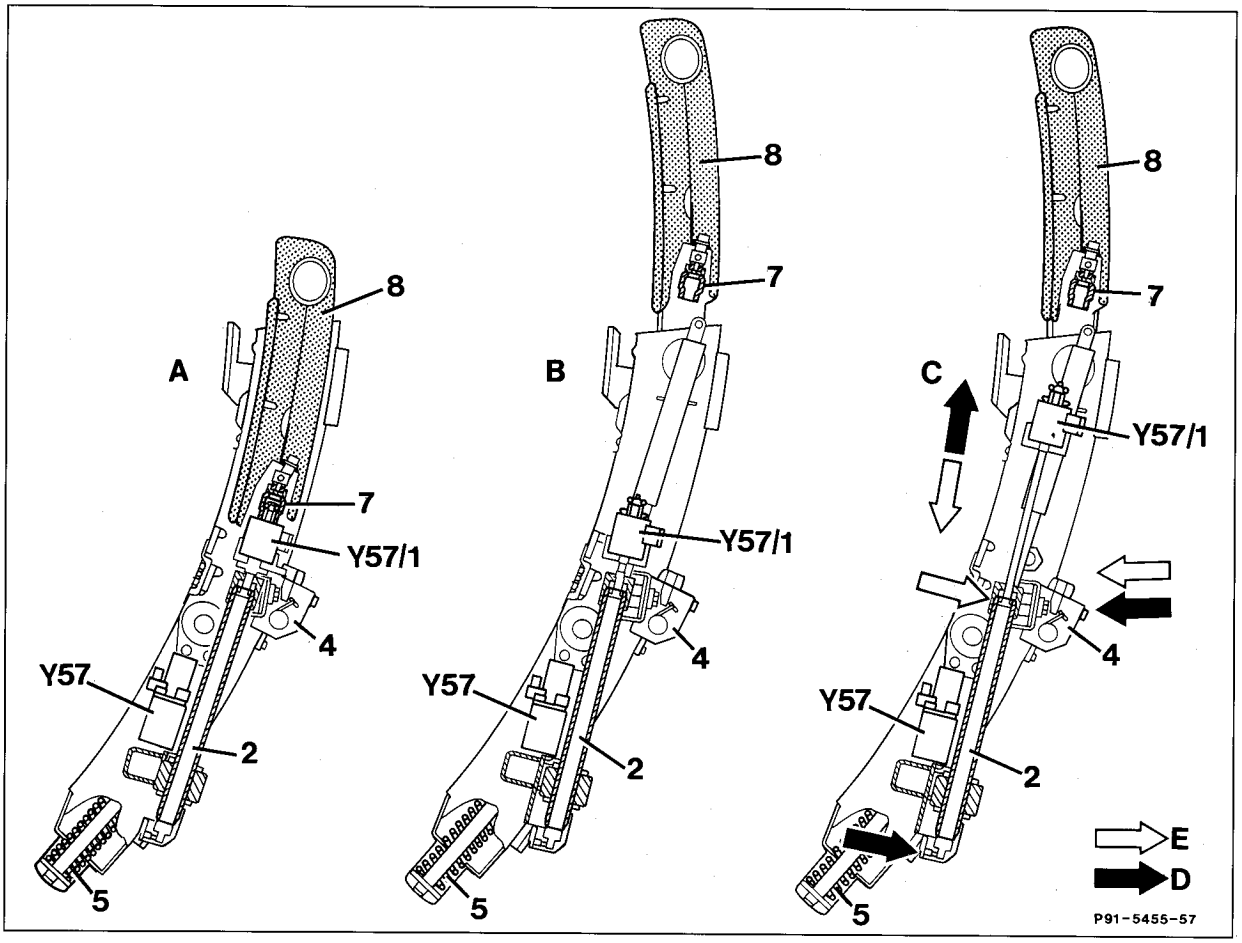


Table: Function of crash actuation and retraction following crash actuation

Figure	A	B	C	
Roll-over bar (8)	retracted	extended	extended	⇒ retracted
Spring (5)	tensioned	released	released	⇒ tensioned
Hydraulic piston rod	retracted	retracted	extends	⇒ retracts
Hydraulic lock	locked	unlocked	unlocked	⇒ locked
Lock (7)	locked	open	open	⇒ locked
Locking pawl (4)	---	in rack	hydraulically pivoted away from rack.	⇒ in rack segment
Triggering solenoid (Y57/1)	---	tripped	---	