

## Lateral Acceleration Sensor (Bosch 5.3)

This new sensor is a major contributor of the expanded capabilities of DSC III.

It is located under the drivers seat but mounted on the vertical surface of the inner rocker sill. (approximately 2" in front of the B pillar).

The drivers seat and door jamb trim must be removed and the floor coverings pulled out of the way to access the lateral acceleration sensor.

### Sensor Operation

The lateral acceleration sensor is connected to the DSC III control module by a 3 pin plug. The sensor receives operating power and ground. In return, it provides a linear voltage signal which is a measurement of "side to side" G-force acceleration.

- The voltage range is from 0.5 to 4.5 volts which corresponds to a G force range of -1.5 to +3.5 g.
- With the vehicle stationary on a level surface, approximately 1.7 volts is present on the signal line. This is indicative of the nominal value of 0.0g.

The sensor is a capacitive type sensor. Under the effects of lateral acceleration, a moving capacitor plate moves in relation to a fixed capacitor plate. The result is a signal proportional to the effect of lateral acceleration.

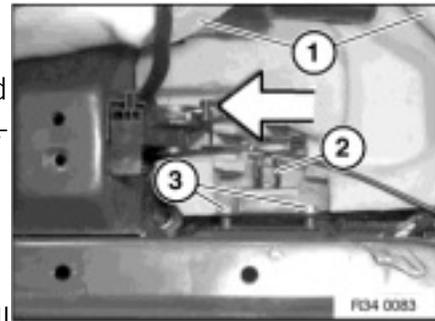
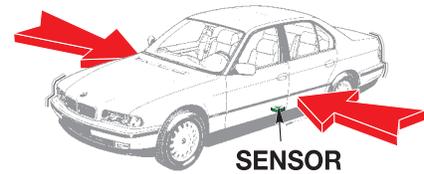
The signal provides additional information which enables the DSC III logic a higher level of sensing the vehicles handling characteristics.

The DSC regulation is calculated from:

- The steering input from the desired vehicle direction from the driver
- The Rotation Rate sensor to determine the "yaw" of the vehicle
- The left and right front wheel speed to verify the turning rate in the corner

These inputs allow the DSC logic to calculate the under/over steer while cornering, and the rate of the vehicle speed entering the corner. For this calculation, the DSC can then compensate by reducing engine torque, and applying the appropriate braking to stabilize the vehicle for safer handling.

RATE OF CHANGE IN SIDE-TO-SIDE MOVEMENT (LATERAL ACCELERATION)



1- Floor Covering 2- 3Pin Plug  
3- Mounting Screws

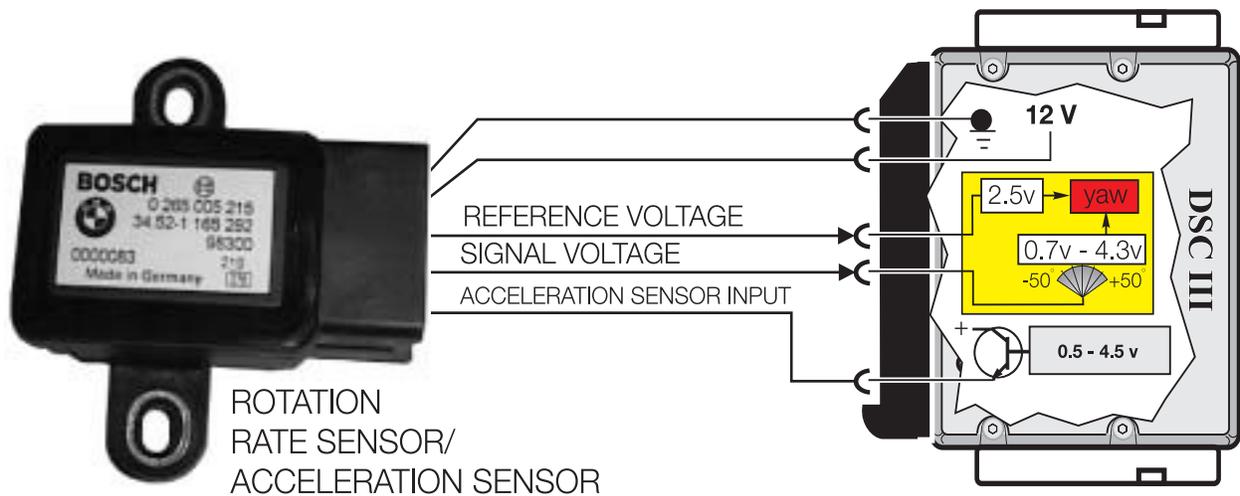
## Combined Rotation Rate/Lateral Acceleration Sensor (Bosch DSC III 5.7)

On DSC III (Bosch 5.7) the Rotation Rate sensor and the Lateral Acceleration sensor have been combined into one unit. The sensor is located under the driver's seat and it is smaller in size and weight and is isolated from chassis vibrations through its rubber mounting.

The sensor provides the same information as the two separate sensors used on DSC 5.3. It receives the same power and ground from the DSC control module.

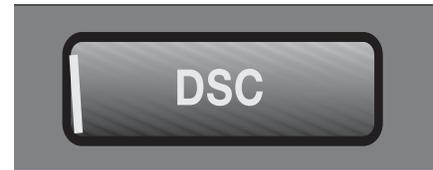
For rotational speed, the sensor produces a reference signal of 2.5 volts and a linear voltage from 0.7 to 4.3 volts. This linear voltage input signal is used by the DSC control module as the degree of rotational rate (yaw).

The sensor also produces a linear voltage signal from 0.5 to 4.5 volts. The DSC control module used this input to determine the side forces acting on the vehicle for DSC regulation.



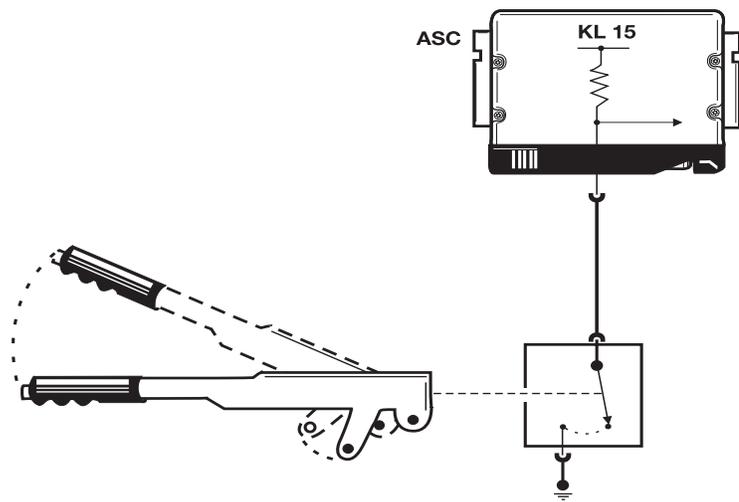
## DSC Switch

The system is active whenever the ignition is switched on. When pressed, the switch provides a momentary 12 volt signal to the DSC control module to switch the system off. The DSC indicator in the cluster will be illuminated to indicate that the system is off. When pressed again, the system switches back on and the DSC indicator goes off.



## Handbrake Switch

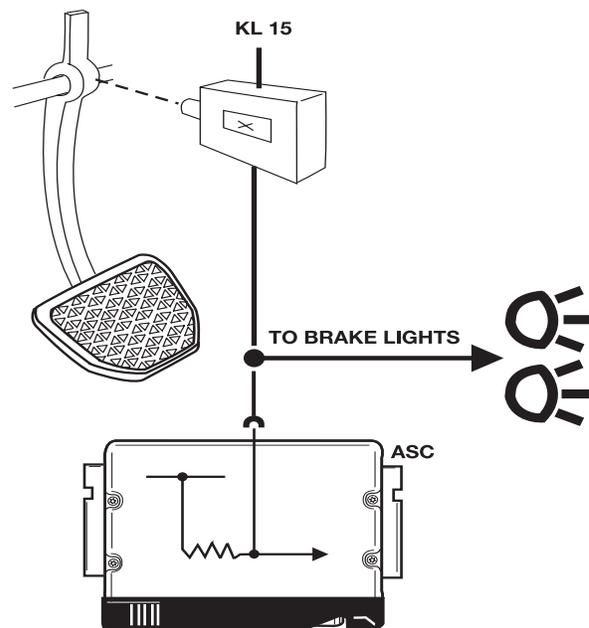
The handbrake switch is a ground input the DSC module. MSR regulation is cancelled when there is a "Handbrake On" signal present



## Brake Switch

The brake switch is used to activate the ABS functions in the DSC III module. If the system receives a brake switch signal when in ASC mode and regulating, ASC regulation is cancelled.

The ABS regulating phase is also cancelled when the brake switch signal is not present

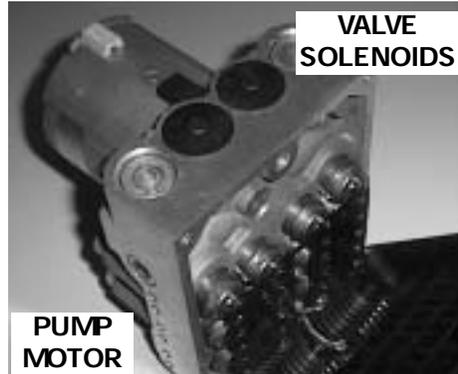


## DSC III (BOSCH 5.3) Hydraulic System Components

As mentioned at the beginning of this section, there are minor differences in the hydraulics for the 750iL compared with the 740i/L and 540iA. The following components are the same for either variation of the system:

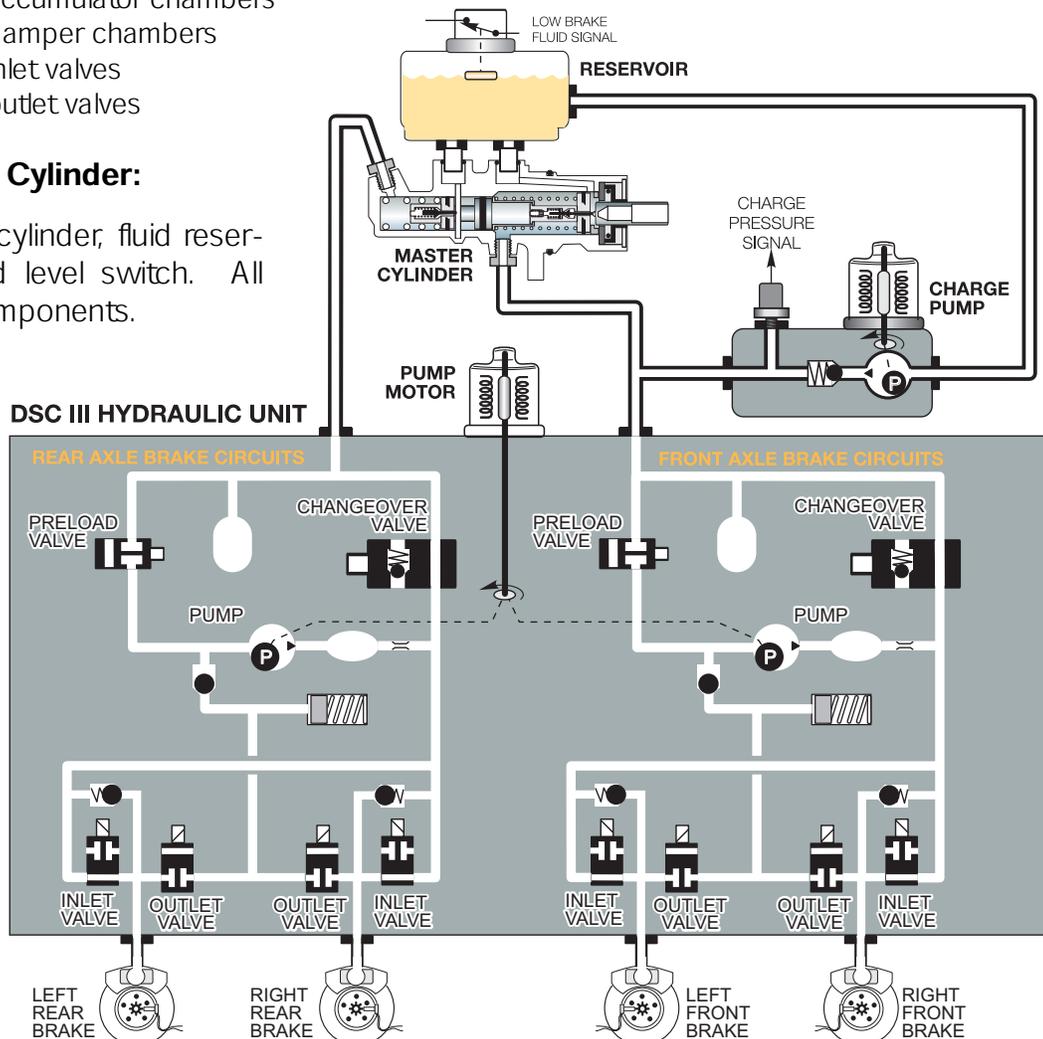
### Hydraulic Unit:

- Similar to DSC II hydraulic unit
- Modulates brake pressure during ABS, CBC, ASC and DSC control procedure.
- Contains:
  - 1 pump motor,
  - 2 return reciprocating pumps
  - 2 preload valves,
  - 2 changeover valves
  - 2 accumulator chambers
  - 2 damper chambers
  - 4 inlet valves
  - 4 outlet valves



### Master Cylinder:

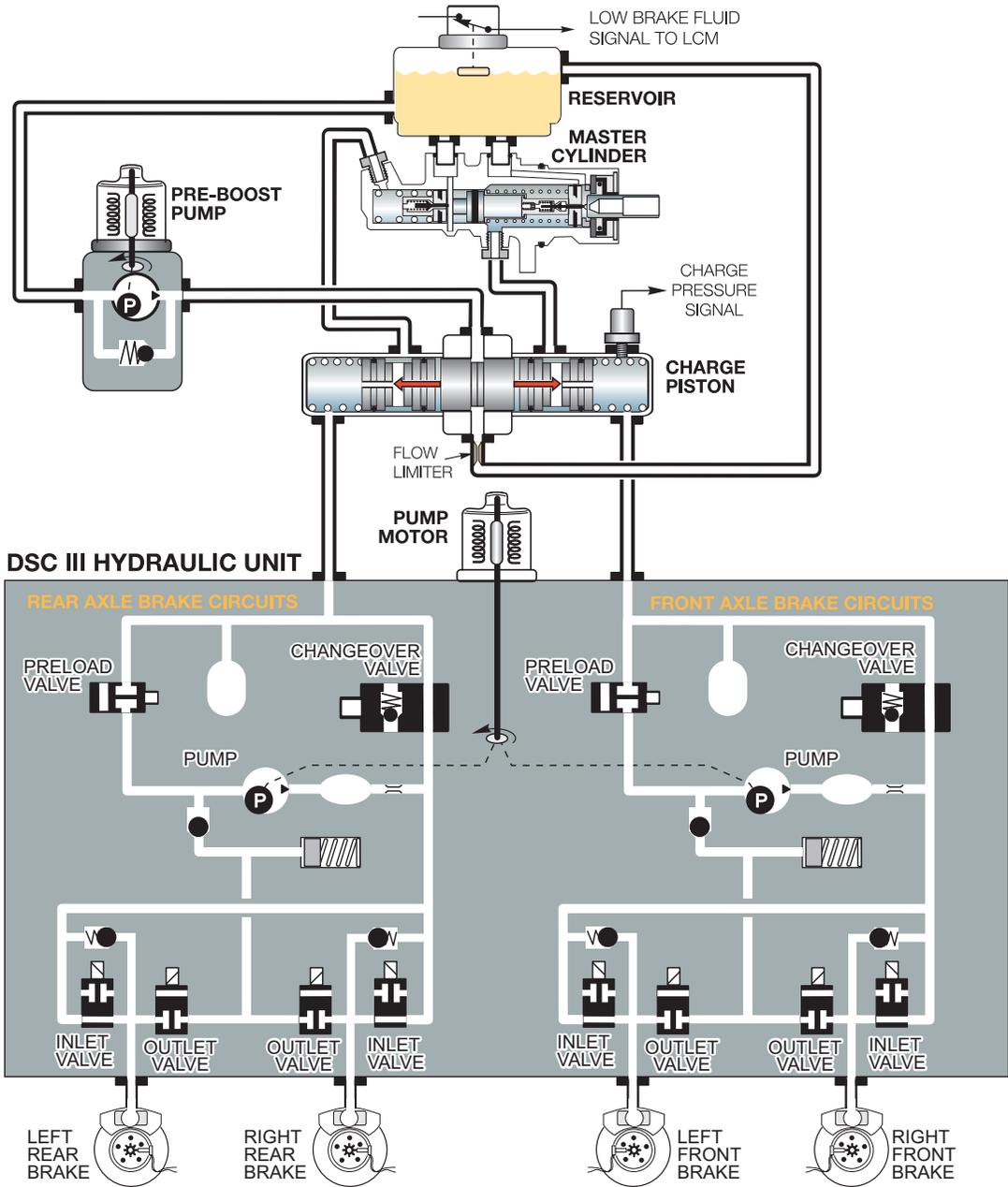
Master cylinder, fluid reservoir and level switch. All new components.



To ensure sufficient brake fluid supply is always available to the hydraulic unit during ASC/DSC hydraulic regulation, the system requires an additional pumping system not equipped on any previous ASC+T system.

The pumping systems are different on the 750iL compared with the 740i/L & 540iA and are as follows:

- **740i/L & 540iA = Charge pump** - located next to the master cylinder.
- **750iL = Pre-boost pump** and separate **charge piston**. These components are also mounted next to the brake fluid master cylinder and fluid reservoir.



## Hydraulic Charge

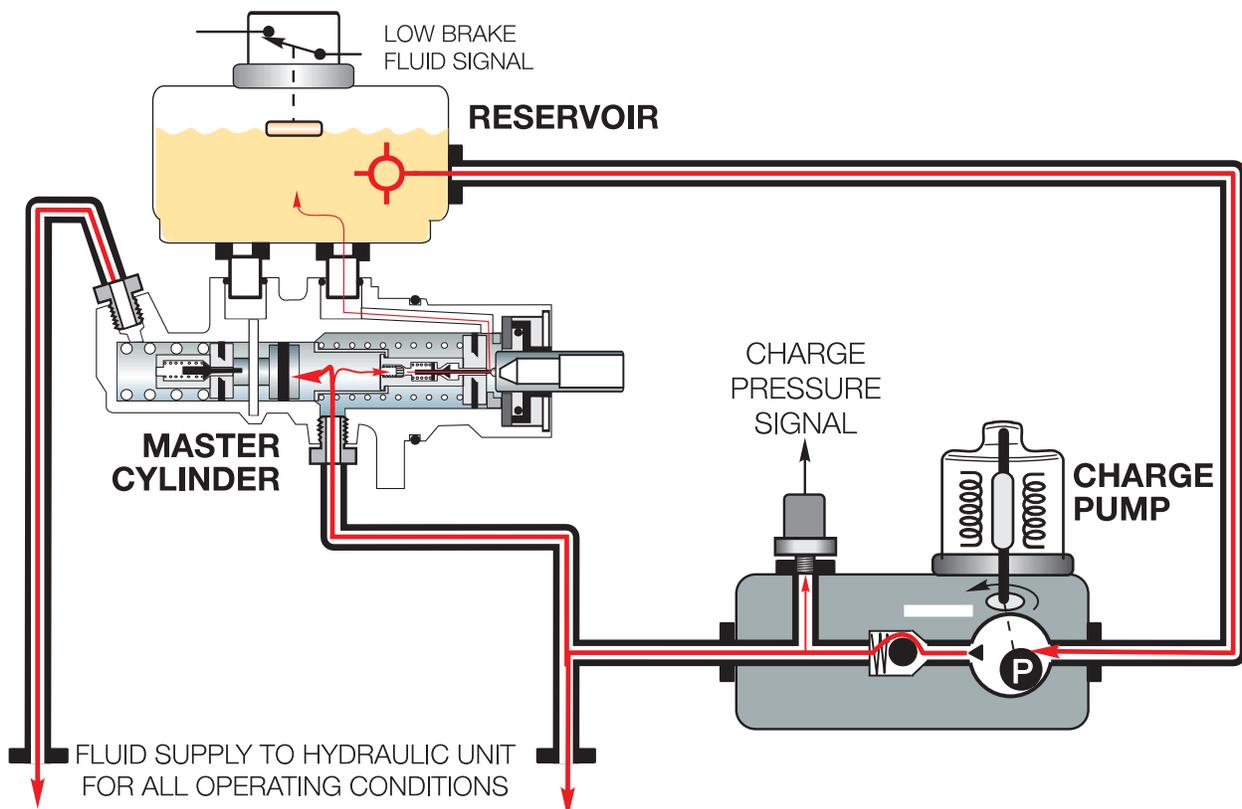
Existing ASC+T and DSC II systems already perform hydraulic control regulation but do not require the additional charge pump systems. Why? The reason being those systems only actuate the rear axle circuits. Obviously, the DSC III system has the capability to actuate front and rear axle circuits together which requires additional hydraulic fluid supply.

For this reason, during an **ASC or DSC regulation** function requiring hydraulic intervention, the DSC III control module switches the electrical charge pump on to provide this additional fluid.

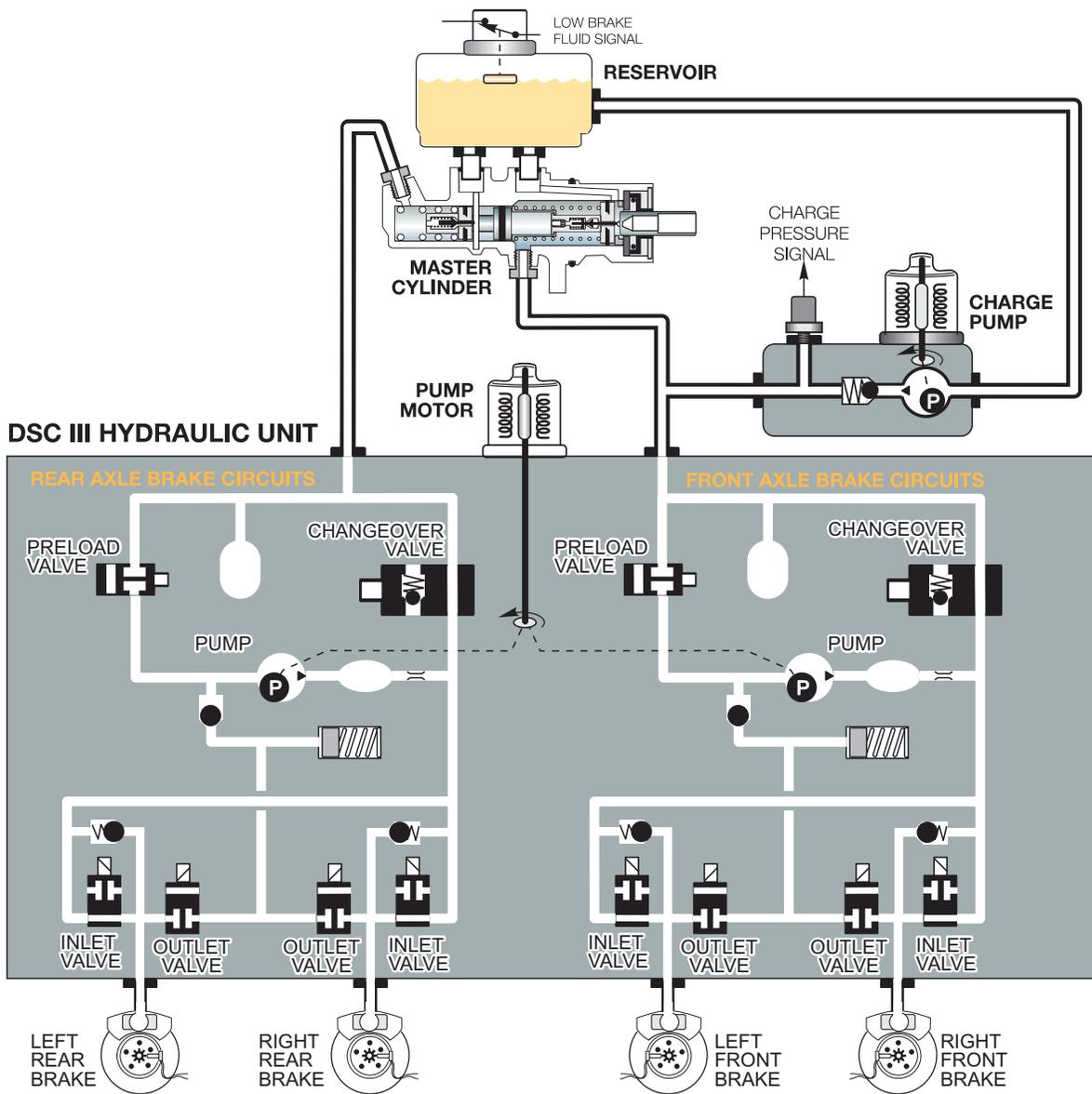
### 740/L & 540A Vehicles:

When activated, the Charge Pump delivers a brake pressure of 10 - 15 bar to the front axle circuit of the hydraulic unit and into the front axle circuit pressure chamber of the master cylinder. The master cylinder piston for the front axle circuit contains a notched restrictor forward of the central valve which allows excess fluid to return to the reservoir under a restriction.

The pressurized fluid also acts on the rear axle circuit of the master cylinder. This provides the hydraulic charge to the rear axle circuit of the hydraulic unit as needed.







---

## Principle of Operation

### Dynamic Stability Control Systems

#### Introduction

Dynamic Stability Control (DSC III version 5.3) was introduced on the 1998 Model Year E 38 and E 39 - 540 vehicles. For Model Year 1999, the system is enhanced with additional control functions and a new combined rotational rate/lateral acceleration sensor as version 5.7. It continues to be offered as standard equipment in the E 38 and E 39 - 540 models. The new functions are titled as the Dynamic Braking System and include the:

- Dynamic Brake Control (DBC)
- Maximum Brake Control (MBC)

DSC III adds a further dimension to the dynamic stability control system. DSC II has the ability to mildly correct for lateral instability and only at the rear brakes when braking control is necessary. DSC III has the ability to brake any wheel during cornering maneuvers where the control module's programmed limits for vehicle oversteer and understeer are exceeded.

New sensors are added to the DSC III system to monitor the rotational rate of the vehicle around its vertical axis and a lateral acceleration sensor to monitor the side to side forces on the vehicle.

The hydraulic system of the DSC II has also been modified to allow brake regulation on the front wheels and to ensure that the supply of brake fluid for DSC II regulation is maintained.

Two different hydraulic systems are used on the Bosch 5.3 DSC system as follows:

- 740i/L & 540iA use a charge pump for the front brake circuit
- 750iL uses a boost pump and separate charge piston for both the front and rear brake circuits.

The hydraulic system used on the Bosch DSC III 5.7 has changed on the E 38 and E 39. The 750iL now uses a similar hydraulic system to the 740i/L and 540i. The charge piston and pre-boost pump have been eliminated. The brake pressure sensor is now located in the hydraulic unit on all Bosch 5.7 systems.

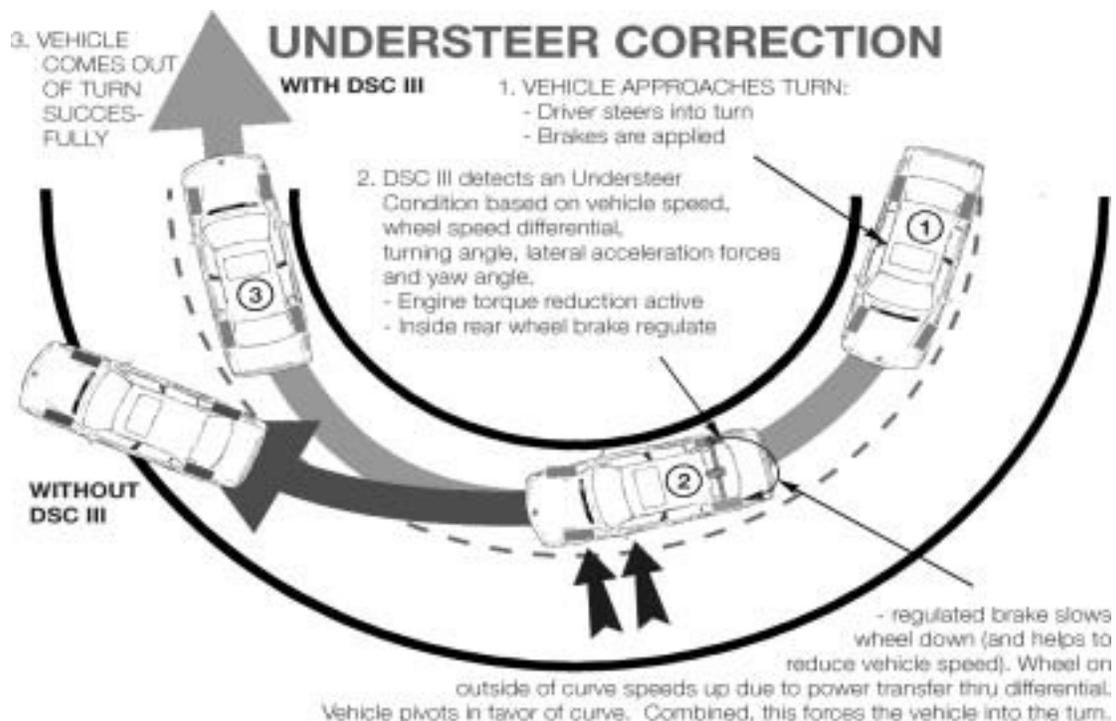
## Dynamic Stability Control (DSC III)

All of the familiar braking and straight line traction control features and system communication carry over from DSC II. Based on select high/select low logic, the DSC III control module selects a vehicle stabilizing strategy based on the specific input signal values it is monitoring at the moment. For all DSC strategies this begins with engine intervention to reduce torque:

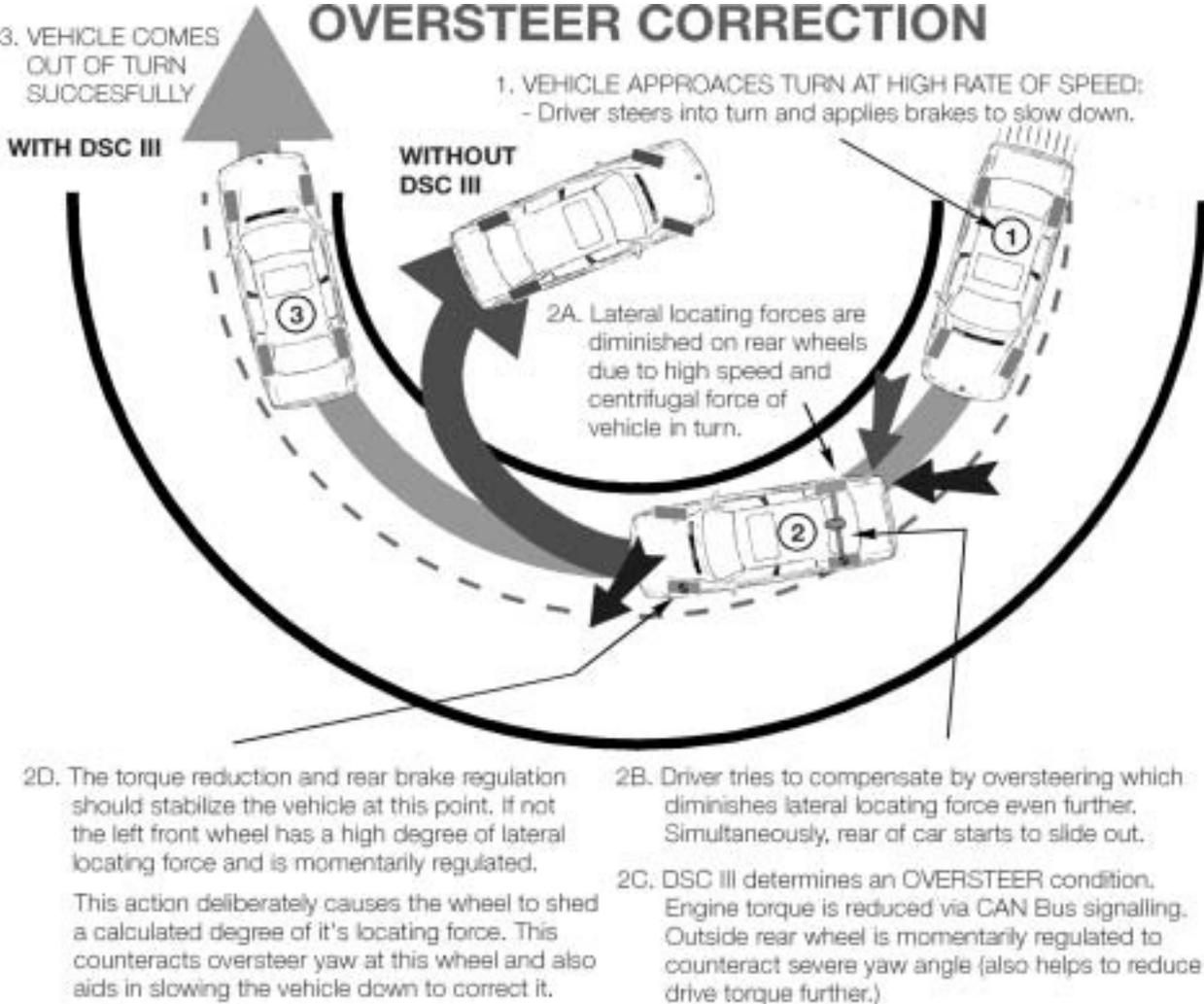
- For the 750iL this is handled via CAN communication, DSC III to EML to minimize the throttle angle of the DK motors (750iL). For the 740i/L and 540iA this is handled by direct DSC III activation of the ADS II throttle housing.
- If additional torque reduction is necessary, DSC III informs DME over CAN to:
  - a. Retard ignition timing
  - b. Shut down the fuel injection to individual cylinders

DSC III monitors under/oversteer conditions through the following components:

- The driver's desired steering angle - steering angle signal over CAN bus.
- Vehicle speed and speed differential at front wheels - wheel speed sensors
- Dynamic forces of lateral acceleration and yaw placed on the vehicle. This is possible with these two new components. The results are as follows:



The expanded hydraulic control of individual wheel circuits is apparent when stabilizing a vehicle exhibiting an oversteer condition as follows:



Transmission system intervention also occurs during any ASC/DSC regulating phase. Through CAN bus communication the AGS control module is informed to delay any gear changes during regulation. This prevents any unwanted driveline dynamic changes during DSC regulation.

Though DSC III provides state of the art, electronic correction of undesirable vehicle handling characteristics, it is important to remember vehicle stability is always subject to the physical laws of centrifugal force and extreme road conditions. **Good judgement and common sense on the part of the driver are still required.**

---

## DSC Features

### Corner Braking Control (CBC)

CBC is a feature of dynamic stability control that is designed to improve the vehicle's stability if the driver brakes while driving through a curve. If the vehicle is braked while driving through a curve, an unequal braking force will be applied to the wheels due to the weight shift of the vehicle to the outside of the turn. Based on the vehicle speed and the speed differential of the two front wheel speed sensors, the control module can determine if CBC needs to be activated when the driver applies the brakes. If CBC is activated, the regulation will pulse the wheel brakes on the outside of the vehicle to provide an equal braking force on all four wheels.

### Dynamic Braking System (DBS)

The dynamic braking system is designed to enhance the braking control of the DSC for the driver of the vehicle. The dynamic braking control and maximum braking control are functions that are programmed into the control electronics of the DSC with no additional hardware changes. The Dynamic braking system features consist of DBC and MBC.

### Dynamic Braking Control (DBC)

The DBC function is designed to provide the maximum braking force available during rapid (panic) braking situations. The DSC control module looks at the inputs from the brake pedal switch and the signal from the brake pressure sensor on the master cylinder. The criteria for activation of DBC is how rapidly is the brake pressure built up with the brake pedal depressed. The total criteria required for DBC activation includes:

- Brake switch ON
- Brake pressure build up > threshold value
- Vehicle road speed > 5MPH
- Vehicle not in reverse
- Not all wheels in ABS regulation

If the threshold for DBC activation is achieved, the DSC control module will activate a pressure build up regulation phase through the hydraulic unit. The pressure at all wheels is increased up to the ABS regulation point. This occurs even if the driver does not achieve the ABS regulation point with the pedal.

The rear axle brakes are controlled with select-low regulation and the front axle brakes are controlled individually. ABS regulation will continue until the driver releases the pedal and the pressure in the master cylinder drops below the threshold value stored in the DSC control module.

---

## Maximum Brake Control

The MBC function is also designed to enhance a driver initiated braking procedure. The MBC will build up the pressure in the rear brake circuit when the front brakes are already in an ABS regulation cycle. The additional braking pressure at the rear wheels will shorten the stopping distance. The following criteria must be met before the DSC control module will activate MBC:

- Both front wheel brakes in ABS regulation
- Vehicle speed > 5 MPH
- Vehicle not in reverse
- DBC and pressure sensor initialization test OK
- Rear wheels not in ABS regulation

## Diagnosis

The following diagnostic functions are available using the DISplus or GT-1.

### Control Unit Functions:

Expert mode diagnosis available at any time during troubleshooting. To enter: press the Control Unit Functions button at the right lower corner of the screen.

The contents are:

- **Identification**
- **Delete Fault Memory**
- **Read Fault Memory**
- **Component Activation**
- **Status queries (requests)**

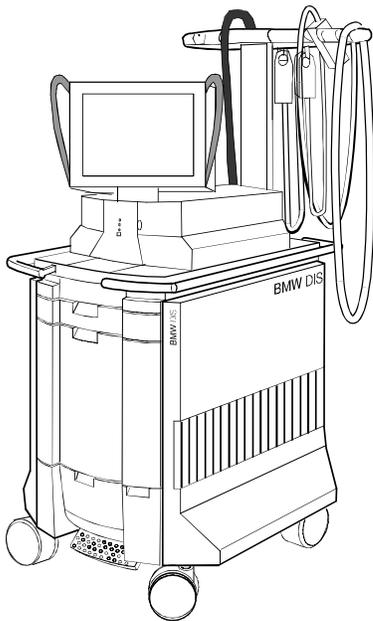
### Service Functions:

Provides access to specialized test modules used as post repair procedures. To enter:

- Function Selection
- Service Functions
- Chassis
- Dynamic Stability Control

The contents are:

- **Connection Speed Sensor:** A test to verify the proper wiring to the wheel speed sensors
- **Connection Brake Lines:** A test to verify the proper brake pipe connections to the hydraulic unit
- **Adjustment Functions:** Test modules to initialize certain components after repair work is performed
  - Steering Angle Sensor
  - Lateral Acceleration Sensor
  - Pressure Sensors

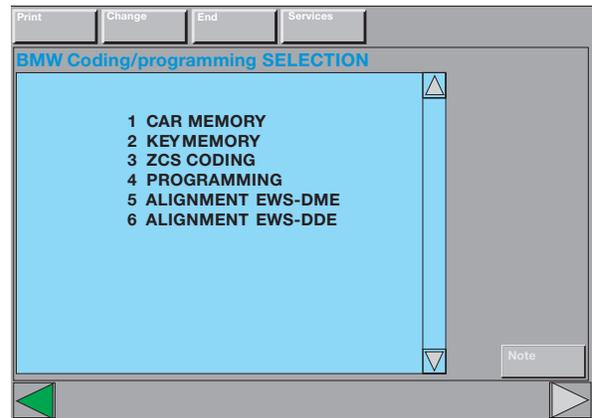


**Test Modules:** Faults with the DSC III system can be diagnosed using fault or symptom driven test modules. To begin diagnosis:

- **Perform the Quick Test.**
- **Select Vehicle Symptom from the Symptom Selection page.**
- **Select Test Module from Test Plan page.**
- **Press the Test Schedule Button.**

## Coding

Coding must be performed after replacement of the DSC III control module or the steering angle sensor. ZCS coding is found in the Coding and Programming selection from the start screen or when pressing the Change button. Follow on-screen instructions for initialization of components after completing the coding process.



## Adjustment Functions

Adjustment (initialization) is required when:

- Replacing the DSC III Control Unit
- Replacing/Re-coding the Steering Angle Sensor.
- Replacing one or both Brake Pressure Sensors.
- Replacing Lateral Acceleration Sensor.

## Steering Angle Sensor

The steering angle sensor requires an offset adjustment after the sensor has been replaced, coded or after repairs to the steering or suspension system. The offset adjustment informs the steering angle sensor processor of the straight ahead position of the front wheels.

The adjustment is performed by completing the Test Module found in Service Functions. Once the adjustment is complete the sensor sends an identification number over the CAN bus to the DSC control unit. The ID provides confirmation that the steering angle sensor is coded and has successfully completed the adjustment procedure.

## Special Tools

Special Tools available for the DSC III system consist of:

Tool #	Description	Purpose
34 5 240	42 Pin V-Cable	For B.O.B. 61 4 390
61 4 390	60 Pin B.O.B.	For pin by pin diagnosis
34 5 160	Pressure Sensor Socket	For installation and removal of hydraulic brake pressure sensor.
61 4 420	83 Pin B.O.B.	For pin by pin diagnosis of Bosch DSC III 5.3 and ASC +T5