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Features and Technology

Initial Print Date: 06/08 Revision Date: 04/10

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Features and Technology

Model: All

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OBJECTIVES

After completion of this module you will be able to:

- Familiarize yourself with some of the technology in BMW vehicles
- Be able to set the correct time, date and radio stations on all BMW models
- Familiarize yourself with the different sound and navigation systems on all BMW models

Introduction

BMW defined the sports luxury vehicle division. Over the years other automobile manufacturers have tried to obtain some of the market share originally held exclusively by the BMW.

Other manufacturers have copied our designs, handling characteristics, and even our marketing styles, but BMW continues to be the benchmark for setting standards. For BMW to maintain its leadership position in this category it requires innovative design concepts and technology.

BMW Group Research and Innovation Center (FIZ)

BMW World and BMW Group Corporate Headquarters

http://www.bmw-welt.com

This section is intended for new center personnel as an overview of some of the technology behind BMW vehicles. Specific information on these systems discussed in this section can be found in TIS under Technical Training Information.

The topics are divided into three major sections which are:

- Drivetrain
- Chassis/Suspension
- Body Electronics

Design

The Roundel

BMW was founded in 1916 and the most recognizable of all BMW design elements is its distinct logo, known as the Roundel. Seen from a distance, even as a blur, the blue-and-white propellers of the Roundel signal that you're in the presence of greatness. With its colors deriving from the Bavarian flag and the propeller motif symbolizing BMW's origins as a manufacturer of aircraft engines, the Roundel expresses the pride and sense of tradition that go into the design of every BMW.

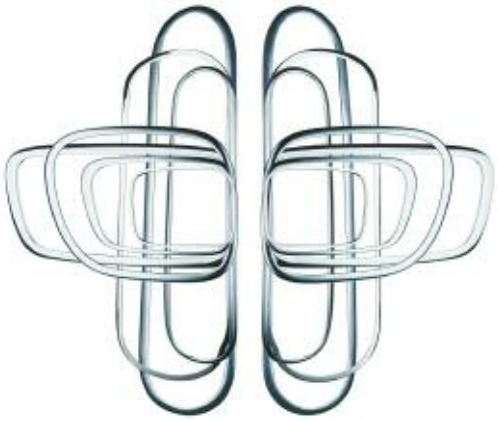
Quad Headlights

The four round headlights or "eyes" of the BMW represent one of the most recent BMW design elements. They first emerged with the six-cylinder 320i and 323i as a rank marker designed to distinguish them from "lesser" 3s that sported only two headlights. By the late 1980s, the four-eyed look had become the norm for most BMWs and remains a distinctive marker today.

Optimum Weight Distribution

All current BMWs have their front wheels relatively far forward and their engine as far back as practical. BMW even positions the battery toward the rear of the vehicle to distribute its relatively heavy weight. The resulting weight distribution comes within 3.3% of the ideal 50/50 balance, far closer than most cars deliver. BMW fore-aft weight balance aids handling during braking, cornering and accelerating. Optimum balance for optimum performance.

Kidney Grills



One of the most visible of BMW design elements, often seen rising up in rear-view mirrors, is the traditional "kidney" grille. Introduced at the 1933 Geneva auto show on the BMW 303, the distinct shape of the kidneys first emerged from an effort to reduce aerodynamic drag. Over time, they have evolved from tall ovals into their now-emblematic
low, wide kidney-like shape. They continue to symbolize the timelessness of BMW design and engineering.

Hofmeister Kink

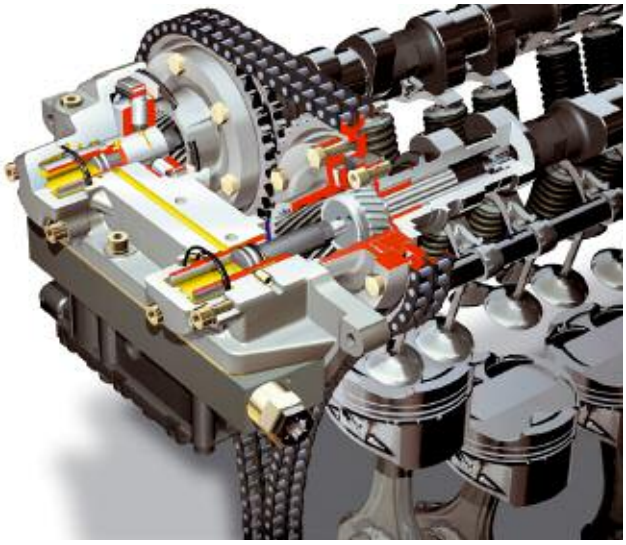
Certainly the BMW element with the most unusual name is the Hofmeister kink, the distinctive bend in every BMW's C-pillars (the metal roof supports that separate the rear side windows from the back glass). Although it appeared as early as the 1930s, the kink formally debuted with the "New Class" 1500 Sedan at the 1961 Frankfurt auto show and was named after Wilhelm Hofmeister, then director of design for BMW. Aside from its pleasing visual effect, the Hofmeister kink subtly highlights a BMW trademark: rear-wheel drive.

Aerodynamic Design

The mantra of BMW design is "form follows function." For example, the integrated front spoiler on all BMWs reduces the amount of air flowing under the car, hence minimizing front-end lift at speed. The very shape of BMWs is a result of precise aerodynamic engineering. Each closed-body BMW has been designed for a low drag coefficient. With air flowing smoothly over the body, the engine has less drag to overcome. BMWs are also designed to minimize aerodynamic lift. Thus the legendary cornering and road-hugging agility of The Ultimate Driving Machine®.

Drivetrain

VANOS



VANOS is a combined hydraulic and mechanical camshaft control device managed by the vehicle's engine management system. VANOS was introduced for the US in 1992 on the 5 Series equipped with a M50B25 engine.

VANOS significantly enhances emission management, increases output and torque, and offers better idling quality and fuel economy.

The VANOS system is based on a mechanism that can modify the position of the intake camshaft relative to the crankshaft. Double-VANOS adjusts both the intake and exhaust camshafts.

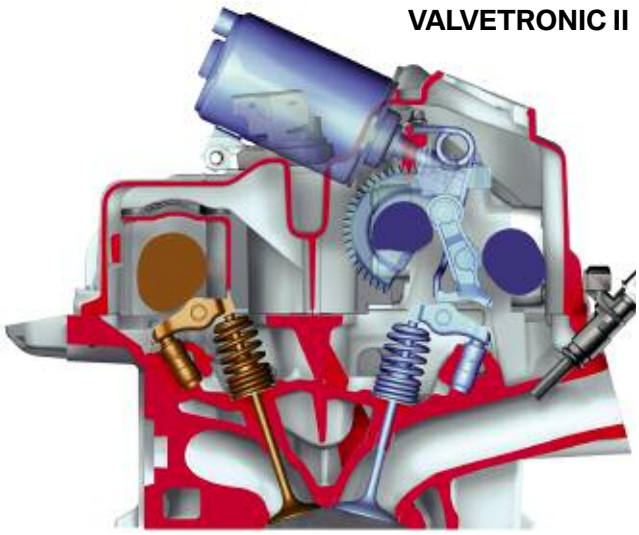
VANOS operates on the intake camshaft in accordance with engine speed and accelerator pedal position.

- At the lower end of the engine-speed scale, the intake valves are opened later, which improves idling quality and smoothness.
- At moderate engine speeds, the intake valves open much earlier, which boosts torque and permits exhaust gas re-circulation inside the combustion chambers, reducing fuel consumption and exhaust emissions.
- At high engine speeds, intake valve opening is once again delayed, so that full power can be developed.

An advantage of double-VANOS is that the system controls the flow of hot exhaust gases into the intake manifold (EGR valve function). This is referred to as "internal" exhaust gas re-circulation, allowing small amount of exhaust gas to be recycled.

Valvetronic

VALVETRONIC II



Valvetronic was introduced in the US on the MY2002 E65 7 Series vehicle equipped with the N62B44 engine.

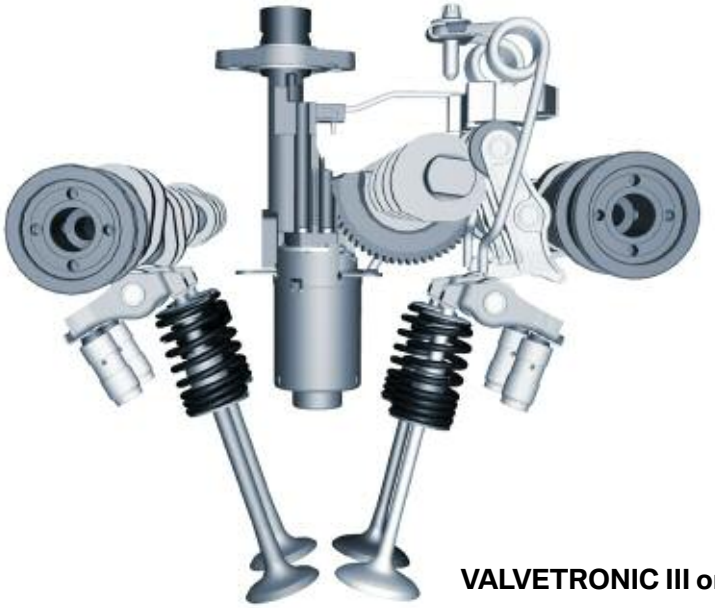
Valvetronic engines use a combination of hardware and software to eliminate the need for a conventional throttle mechanism. A Valvetronic engine replaces the function of the throttle butterfly by using the amount of valve lift to regulate the amount of air entering the combustion chamber.

The valves are of a conventional design, but the intake camshaft uses a secondary eccentric shaft with a series of levers and roller rockers, activated by a motor. The motor moves the eccentric shaft and varies the position of the pivot point of the rocker thus changing the amount of valve lift achieved.

In the beginning the Valvetronic System required its own computer (separate unit) apart from the engine management system. It was networked to the engine control module by the use of a high speed CAN bus. With the introduction of the N52 engine though, the management of the Valvetronic System was incorporated into the DME.

Benefits:

- Valvetronic reduces maintenance costs, improves cold start behavior, lowers exhaust emissions, and provides a smoother running engine. Valvetronic does not need specific fuel grades or fuel qualities because of its fine atomization of fuel.
- Because Valvetronic allows the engine to breathe more freely, fuel consumption is reduced by 10%. The fuel savings are greatest at lower engine revolutions and allow for decreased engine emissions.
- In an engine with no VALVETRONIC, at light throttle the throttle butterfly partially or even nearly closes. The pistons are still running, taking air from the partially closed intake manifold. The intake manifold between the throttle and the combustion chamber has a partial vacuum, resisting the sucking and pumping action of the pistons, thus wasting energy. Automotive engineers refer to this phenomenon as "pumping loss". The slower the engine runs, the more the throttle butterfly closes, and the more energy is lost.
  Compared to the conventional engine where the load is controlled by the throttle valve, pumping loss is lessened in an engine with VALVETRONIC by reducing valve lift and the amount of air entering the combustion chambers.
- In Valvetronic engines coolant flows across the head, resulting in a temperature reduction of 60%. The water pump size is cut in half, reducing power consumption by 60%.



VALVETRONIC III on N55

Direct Injection

The term “direct injection” refers to a fuel injection system which injects fuel directly into the combustion chamber rather than into the intake manifold. This technology has been around since the 1920’s, but has not been in widespread use until the late 20th century. The first passenger car to run on direct engine was a car called the “Gutbrod” in 1952.

The first application of this technology on a BMW was in 2003 on the 760Li. The N73 V-12 engine utilizes the latest direct injection technology combined with VALVETRONIC.

For the 2007 model year, BMW has introduced a 6-cylinder engine with direct fuel injection. The N54, which is turbocharged, uses the second generation of direct injection (DI 2), which is referred to as High Precision Injection (HPI).

As the name suggest, the direct injection (DI) system use a fuel injector which sprays fuel directly into the combustion chamber. The fuel injection pressure (N54) varies from 50 to 200 bar, depending on the engine’s speed and load. The A/F mixture in a DI engine is formed inside of the combustion chamber.

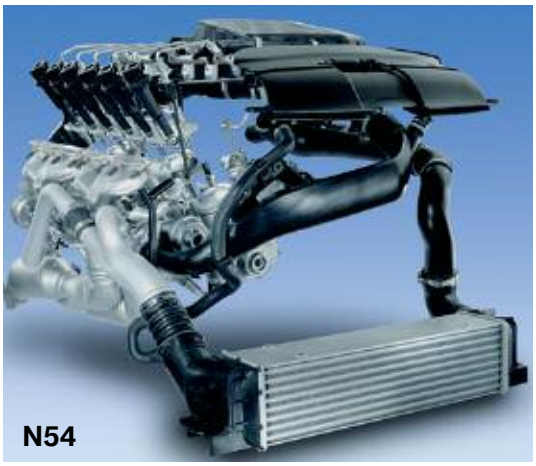
In 2010 BMW introduced the N55 engine with high pressure fuel injection system (HDE). In contrast to high precision injection (HPI) solenoid fuel injectors with multi-hole nozzles are used, as opposed to the piezo-injector units used in the N54.

In comparison, a manifold injection system sprays fuel into the intake manifold or into the intake port near the intake valve. In this case, the A/F mixture is formed outside of the combustion chamber. The injection pressure on most manifold injection systems is between 3 and 5 bar.

The DI system allows for increased engine efficiency and has several distinct advantages over manifold injection systems:

- The fuel is evaporated and atomized in the combustion chamber, which provides a “cooling effect” on combustion. A cooler combustion chamber allows an increase in air density, which allows for more available oxygen. In addition, cooler combustion allows for an increase in compression ratio which equates to improved efficiency and engine power.
- By injecting the fuel directly into the combustion chamber, there is less possibility for fuel to condense or accumulate on the manifold walls or the back of the intake valve. This results in less fuel needed to achieve the desired A/F ratio.
- The increased injection pressure causes the fuel droplet size to be reduced. This allows for improved atomization and therefore improved mixture formation. Efficiency increases in total by up to 10%.

Turbocharging


N54

Until now, BMW has built a reputation for building high performance engines which are naturally aspirated. Much research has gone into the development of an efficient engine design which meets not only the expectations of the customer, but complies with all of the current emissions legislation.

Currently, the global focus has been centered around the use of alternative fuels and various hybrid designs. While BMW recognizes these concerns, there is still much development to be done on the internal combustion engine. Therefore, BMW will continue to build some of best internal combustion engines in the world.

That is why in 2006 BMW introduced the N54 engine as the first turbocharged powerplant in the US market. In addition to turbocharging, the N54 features second generation direct injection and Double-VANOS.

As far as gasoline engines are concerned, turbocharging has not been in widespread use at BMW. As a matter of fact, the last turbocharged BMW production vehicle was the E23 (745i) which was not officially imported into the US. The previous “turbo” model before that was the legendary 2002 tii turbo in the early 1970’s. This 2002 tii turbo was also not officially imported into the US.

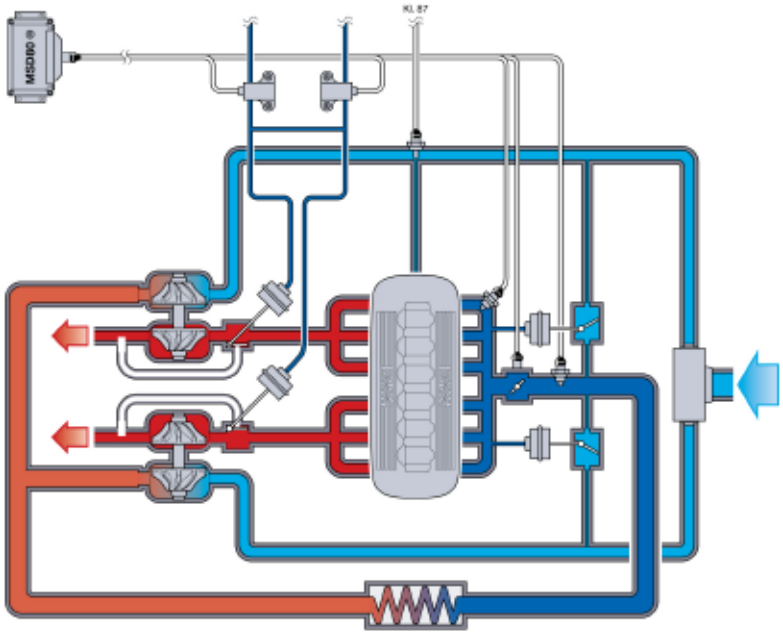
Principles of Operation

The turbocharger consists of a turbine and compressor assembly on a common shaft inside of the turbocharger housing. A turbocharger is driven by waste (exhaust) gasses and in turn drives a compressor which forces air into the engine above atmospheric pressure. This increase pressure allows for an air charge with a greater density. The result is increased torque and horsepower. The turbine and the compressor can rotate at speeds of up to 200,000 rpm and the exhaust inlet temperature can reach max temperatures of up to 1050ºC.

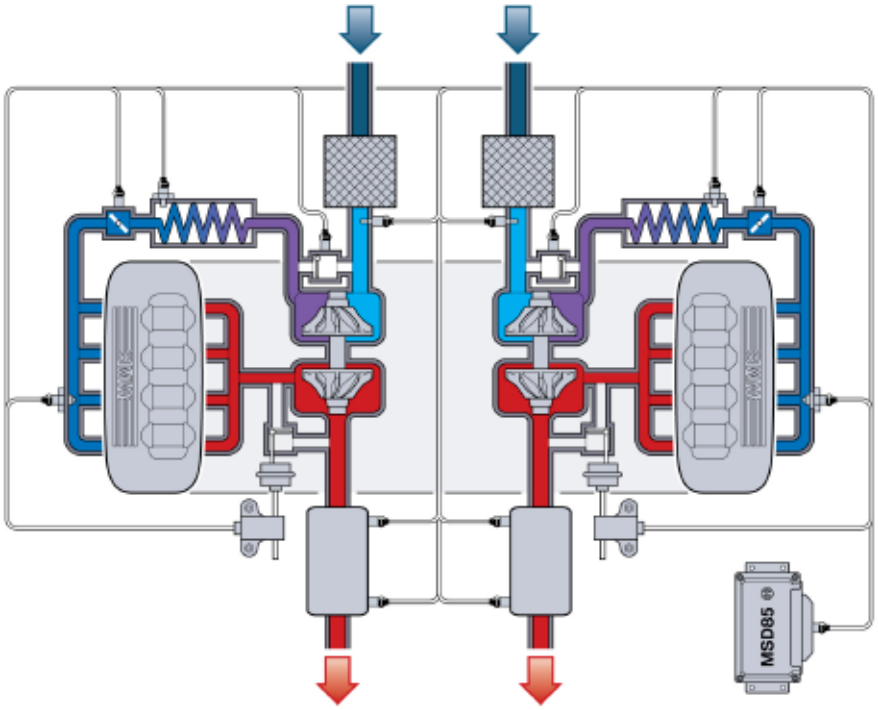
This increased density during the intake stroke ultimately adds up to the creation of more engine output torque. Of course, this increased density must be accompanied by additional fuel to create the desired power. This is accomplished by engine management system programming to increase injector “on-time” and enhance associated maps.

The use of an exhaust driven turbocharger is used to create more engine power through increased efficiency. In the case of BMW turbocharged engines, the turbocharger is used in conjunction with direct fuel injection. This provides the best combination of efficiency and power with no compromise.

N54 Turbo schematics



N63 Turbo schematics



Bi-turbocharging

A major advantage of the smaller-sized turbochargers is their low moment of inertia. Even the slightest impetus given by the driver with the accelerator pedal receives a response with an immediate build-up of pressure. The lag typically experienced until now in turbocharged engines - i.e. the time it takes for the turbocharger to attain its power-delivering effect - is thus no longer perceptible.

This requirement is met in the N54 engine with two small turbochargers, which are connected in parallel. Cylinders 1, 2 and 3 (bank 1) drive the first turbocharger (5) while cylinders 4, 5 and 6 (bank 2) drive the second (2). The advantage of a small turbocharger lies in the fact that, as the turbocharger runs up to speed, the lower moment of inertia of the turbine causes fewer masses to be accelerated, and thus the compressor attains a higher boost pressure in a shorter amount of time.

Twin-scroll Turbo System

The response characteristics of the use of twin-scroll exhaust turbochargers are enhanced when compared to the single-scroll turbos. The S63 turbocharger turbines are fed through two separate channels within the turbine housing (highlighted red in the graphic). Each of these channels or “scrolls” is always fed by the exhaust pulses from the same two cylinders.

The layout and cross sections of the turbine impeller and compressor wheels have been correspondingly adapted and are designed for the maximum exhaust inlet operating temperature of 1020° C (1868° F).

The specially designed exhaust manifold connects each of the 8 cylinders in sequence according to the exhaust pulses in the firing order. This delivers a uniform flow of exhaust gas to the turbochargers which improves volumetric efficiency by promoting cylinder scavenging.

Every 180° of crankshaft rotation, one exhaust gas pulse is fed to each turbocharger over the entire ignition sequence (1–5–4–8–6–3–7–2).

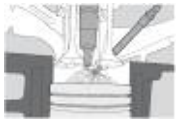
This highly efficient charging concept achieves optimum energy transmission of the exhaust flow to the turbine blades of the turbochargers. The result is the fastest and most direct response characteristics of any turbo engine worldwide. The innovative technology is patented by BMW and therefore represents a unique selling point over the competition.

EfficientDynamics

The sheer pleasure that driving a BMW creates is legendary. But the factors that trigger this intensity of emotion are cutting-edge: a unique symbiosis of outstanding dynamism and unsurpassed efficiency. In short: BMW EfficientDynamics. A package of concepts that uses a whole host of innovative technologies to effect a significant reduction in fuel consumption and in vehicle emissions, while at the same time making BMW vehicles even more thrilling to drive. Many of these concepts are already integrated as standard in almost every BMW. What's more, we are currently involved in research to develop alternative energy sources. Because BMW EfficientDynamics also represents a vision – the vision of driving pleasure with no emissions at all. As we work towards this goal, intelligent, demand-led hybrid technologies are being introduced into mass production, under the name of BMW ActiveHybrid.

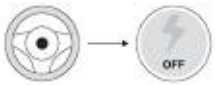
BMW CleanEnergy provides a glimpse of where we hope to arrive in the more distant future. The first BMW Hydrogen 7 models are already on the road – driven by hydrogen, a clean energy source which does not generate any harmful emissions. The Paul Pietsch Award for special innovative developments in the automobile sector, the Green Steering Wheel and the British What Car? Award – in 2007 and 2008 BMW EfficientDynamics won a cornucopia of international awards and most recently, the BMW 118d was named World Green Car of the Year 2008. These awards are a powerful affirmation of our work. But they only serve to drive us on: to work even harder for more driving pleasure and fewer emissions.

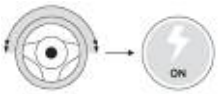
BMW EfficientDynamics include:



- BMW Gasoline Engines. As dynamic as ever. But more efficient than ever before.
- BMW Diesel Engines. The only diesel engines with BMW dynamism.
- BMW Blue Performance. Almost as impressive as its history: the future of the diesel engine.

- Lightweight construction. We save on weight, you save on fuel.
- Optimum Shift Indicator. Cranking efficiency up yet another gear.
- Electric Power Steering. Use the stretches between bends to save fuel.
- Brake Energy Regeneration. Braking to win - to win back energy.
- BMW ActiveHybrid. Reduced emissions. With unlimited driving pleasure.





If you want to learn more about BMW EfficientDynamics go to www.bmw.com access the International website and then click on BMW EfficientDynamics.

Hybrid Technology

In the long term, BMW EfficientDynamics also includes zero-emissions motoring with hydrogen fuel, and in the medium term BMW ActiveHybrid – the combination of internal combustion engine and electric motors in the powertrain. The first production BMW ActiveHybrid models, the hybrid versions of the BMW X6 and the BMW 7-series, will have matured to production status by late 2009.

What does BMW ActiveHybrid stand for and what distinguishes it from the hybrid offerings of our competitors? In principle, BMW ActiveHybrid refers to all hybrid-technology-related endeavours undertaken by BMW to achieve even higher efficiency – in this respect "Active" underscores the highly dynamic performance-motoring claim that will remain a keynote characteristic of all hybrid BMW models to come. BMW ActiveHybrid also refers collectively to the two different modes of hybridization, namely full hybrid and mild hybrid.

Here in brief are the basic differences between the two:

Full hybrid:

- Powerful electric motor or motors capable of delivering enough power to propel the vehicle without the assistance of the internal-combustion engine
- High potential for consumption and emissions reduction, particularly in urban-traffic conditions
- Vehicle weighs more and offers less luggage capacity because the hybrid components take up space and the batteries are heavy
- High component costs, high production costs.

Mild hybrid:

- Small electric motor, designed to assist the combustion engine (boost function)
- Not enough power for all-electric motoring
- Moderate potential for reduction in consumption. Advantages particularly in urban-traffic conditions
- Slight increase in weight and space requirement because the hybrid components are smaller and not as heavy as their full-hybrid counterparts
- Production costs higher than those for conventional IC-engine design, but lower than those for full-hybrid configurations.

BMW's hybrid strategy calls for hybrid technology only in circumstances in which the ratio of additional cost to savings potential justifies the outlay. The launchpad is provided by the high-end models with big engines like the BMW ActiveHybrid X6 and the BMW ActiveHybrid 7, because this is where the efficiency potential is largest. Hybrid technology for smaller models will be a medium-term development.

DCT

BMW presented in the spring of 2008 an enthralling alternative to the 6-speed manual transmission which fascinates drivers with sporty ambitions while at the same time providing all the convenience and comfort of an automatic transmission. The new 7- speed sports automatic transmission with double clutch (DCT/DKG) available in several BMW series, enables even more dynamic acceleration and contributes to the reduction of fuel consumption and exhaust emission levels. It represents the sportiest embodiment of the development strategy BMW EfficientDynamics. The new sports automatic transmission gives the driver the choice between automated shifting and manual gear selection.

In both cases, the 7-speed double clutch transmission shifts without interruption of power delivered to the driven wheels and by consequence enhances traction, thus enhancing both sporty dynamic responses and shift comfort. The result is a unique combination of further increased dynamic performance when shifting manually with the comfort provided by automatic transmissions – and at fuel consumption and exhaust emission levels which are even lower than those of manual transmission vehicles.

A newly designed shift lever is provided in the central console to operate the system. It is clearly differentiated from a conventional automatic transmission selector lever in its shape and its integrated display for the selected shift program; and it does not relay commands for the shift program selection or gear change by means of a mechanical connection but electronically. Alternatively, the driver can carry out manual gearshifts using shift paddles which are attached to the steering wheel.

Principles of Operation

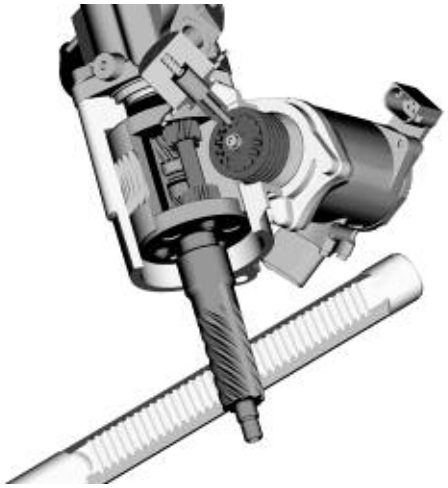
The sports automatic transmission with double clutch is designed for engine speeds of up to 9,000 rpm and torque levels of up to 442lb-ft. This transmission combines two partial gearboxes in one casing, whose compact dimensions are the same as those of a conventional manual transmission. The technical core of the system is provided by two oil-cooled wet clutches. One of the two clutches is for the even transmission stages (2, 4, 6), the other is for the uneven transmission stages (1, 3, 5, 7) and the reverse gear. While the vehicle is moving, one of the two clutches is closed and the other open. During an acceleration maneuver – also when shifting down – they thus operate in alternation.

At every gearshift, the opening of the first clutch happens simultaneously with the closing of the second. The transmission control system identifies the next gear with a transmission ratio which is ideally suited to the relevant engine speed and road speed, selecting it in advance and holding it in readiness. For example, if the vehicle is accelerating in third gear the power transmission is effected through the relevant clutch and partial gearbox with the uneven gears. In the partial gearbox responsible for the even transmission stages, the gear required to continue the acceleration process – in this case the fourth gear – is already engaged. It is then sufficient for the clutch responsible for the fourth gear to close while the clutch for the third gear simultaneously opens: within milliseconds the engine power is transferred to the wheels at the new gear transmission ratio. This enables a jerk-free, comfortable gearshift which is also incomparably fast and without any interruption of traction whatsoever.

NOTES PAGE

Chassis and Suspension

AFS/AL



Active Front Steering (AFS) or Active Steering (AL) was introduced on the E60 5 Series models as part of the Sport Package.

AFS varies the steering transmission ratio electronically in direct relation to the style and speed of driving and road conditions.

AFS is different than variable assist power steering, which only varies the amount of effort, not the actual steering ratio.

Benefits:

- At low and medium speeds, the steering becomes more direct. This requires less turns of the steering wheel and increases the car's agility in city traffic or when parking.
- At high speeds the steering becomes less direct, offering improved directional stability. When cornering at high speeds, or when undertaking sudden movements, the steering wheel will require more input to make the wheels turn.
- AFS works in conjunction with Dynamic Stability Control (DSC) by monitoring the yaw rate and changing the steering angle accordingly. This reduces the number of DSC interventions, providing more control to the driver and increased comfort for the passengers.

AFS works by inserting an electric motor with a worm gear drive that drives a planetary gear set located between the steering rack and the steering column.

When the steering wheel angle senor detects driver input, the AFS control unit registers the data and then powers an electric motor to increase mechanical advantage in terms of rotation amount and turns the front wheels at more or less turns that the driver input. At lower speeds the system dials in a more direct steering ratio allowing a small movement of the steering wheel to result in a greater movement at the road wheels.

IAL

Integrated Active Steering (IAL) is an innovative and logical development of the Active Steering system developed by BMW.

With Active Steering, a steering angle amplification factor reduces the steering effort on the part of the driver and combines the capabilities of “steer by wire” systems with authentic steering feedback.

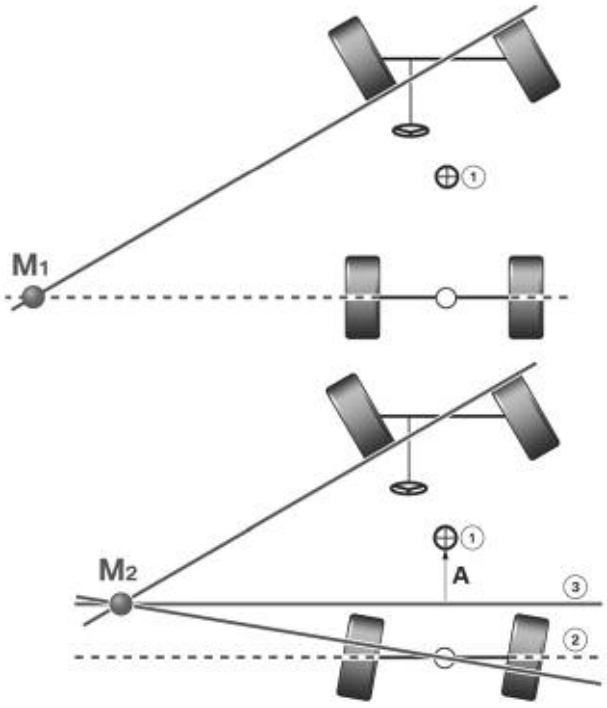
By intervening in the steering independently of the driver’s actions, it is also able to perform a stabilizing function in terms of vehicle handling.

In order to move further ahead in terms of handling dynamics, the familiar Active Steering has now been logically extended by the addition of active rear-wheel steering on the new BMW 7 Series.

Active Steering of the rear wheels is a logical extension of Active Steering and the two are now combined as an all-in one system referred to as Integrated Active Steering.

Integrated Active Steering is available as an option on the F01/F02 because the standard steering system is the Servotronic

Low Speed Range
The variable steering-gear ratio of the Active Steering component reduces steering effort to approximately 2 turns of the steering wheel from lock to lock. In the low speed range up to approximately 37 mph, the variable steering-gear ratio for the front wheels is combined with a degree of opposite rear-wheel steer. The effect is to increase vehicle agility.



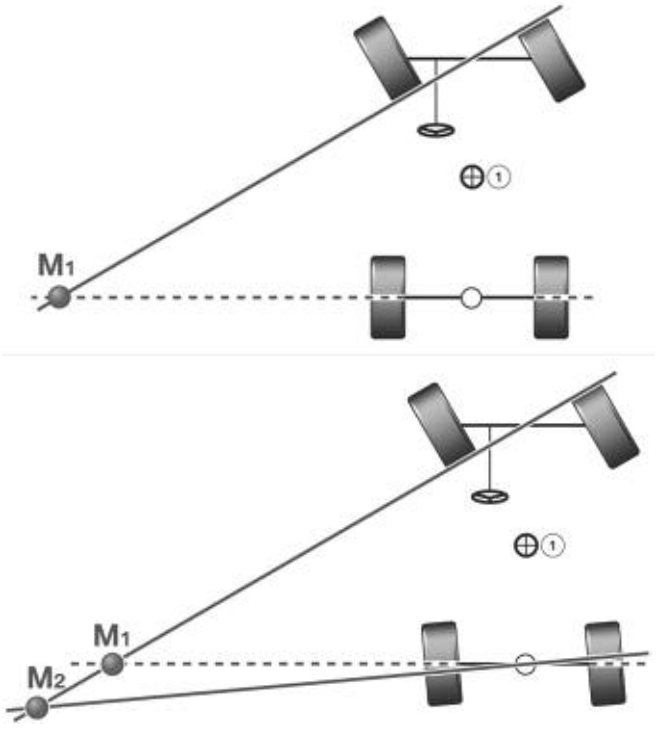
High Speed Range
As the vehicle speed increases, the degree of steering angle amplification by the Active Steering component is reduced. The steering-gear ratio becomes less direct.

At the same time, the steering strategy adopted by the Integrated Active Steering changes. Whereas, at low speeds, the rear wheels are steered in the opposite direction to the front wheels, at higher speeds the rear wheels are steered in the same direction as the front.

The momentary axis moves further back, equivalent to a vehicle with a longer wheelbase, producing more stable straight-line handling. The radius of the curve becomes longer.

By the combination with the Active Steering, an additional amount is added to the steering angle of the front wheels so that the radius of the curve and the required amount of steering lock remain at the familiar level.

All in all, co-ordination of the steering interventions at front and rear makes lane changes and steering maneuvers considerably easier to negotiate without sacrificing agility or balance. Combination of the Active Steering with the new rear-wheel steering system offers benefits for the driver at all speeds.



ARS

Active Roll Stabilization winds up the stabilizer bars in the front and rear suspension to resist body lean while cornering. Because the system is actively controlling only when needed, the spring rates and stabilizer bar stiffness are reduced. This results in a smoother ride.

This system consists of:

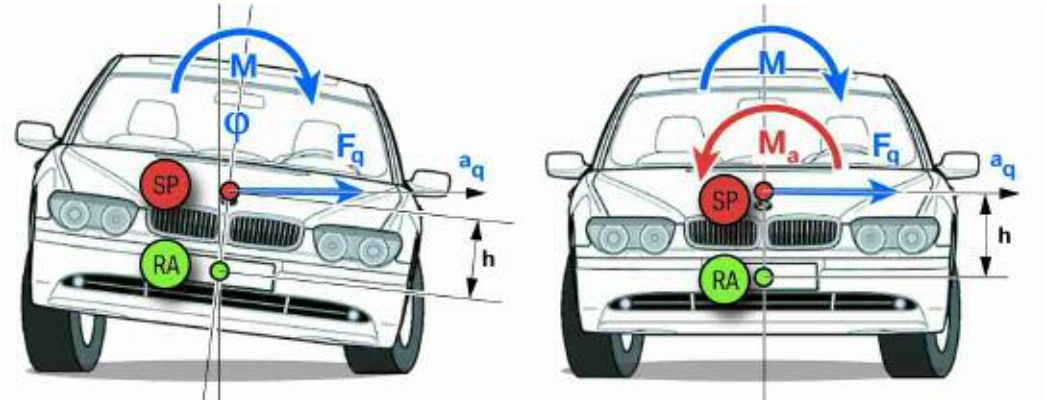
- Active anti-roll bars, replacing conventional mechanical ("passive") front and rear bars. Each bar consists of left and right portions, twisted in opposite directions by a hydraulic motor between them.
- Valve/sensor block containing various system valves and sensors.
- Lateral-acceleration sensor to detect how hard the vehicle is cornering.
- Electronic control unit (ECU) regulating the entire system.
- Tandem oil pump which, via its two sections, provides hydraulic pressure for ARS and the power steering.

Whenever the vehicle enters a corner or begins an avoidance maneuver, "lateral acceleration" is generated. This is read by the sensor, which transmits a signal to the control unit which processes this signal and transmits it to the valve/sensor block. The valve block determines the hydraulic pressure applied to the active anti-roll bars to control body roll.

The key word here is "active."

Active Roll Stabilization:

1. Generates resistance to body roll by twisting the front and rear anti-roll bars
2. Highly "tailored" and stronger than conventional anti-roll bars.
3. Does not offer resistance to bumps as do conventional anti-roll bars.
4. Increases the vehicle's maximum cornering capability.
5. Improves steering response, particularly in the range of cornering where body roll is most tightly controlled.



Tire Pressure Monitoring

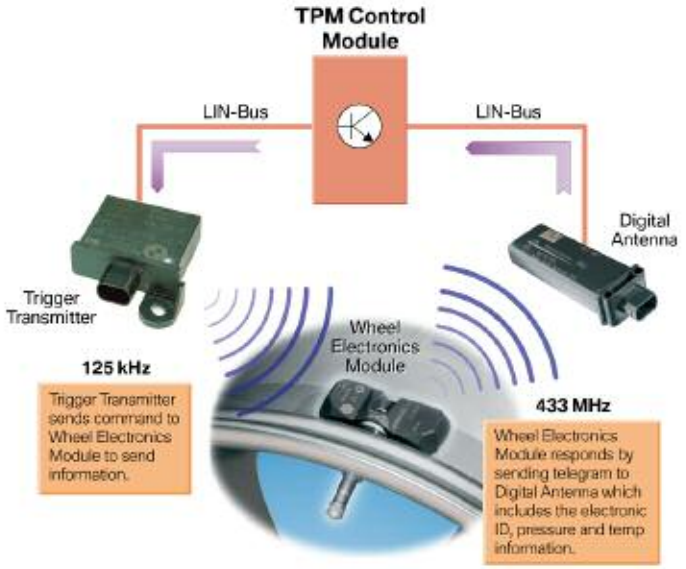
System Identification and Terminology

In order to accurately diagnose TPM systems, the system must be properly identified. These systems have had numerous acronyms which are used to describe the various systems. For the purposes of this training module, the systems will be broken down into two basic configurations.

These are as follows:

- **Systems which monitor wheel speed** - These **"Indirect "** systems will be referred to as Flat Tire Monitoring systems or FTM. FTM systems take advantage of components already installed in the vehicle. The wheel speed sensors, which are already an input to the DSC control unit, are used to monitor wheel speed. When a tire starts to deflate, the overall diameter changes. This affects the rotational speed, which is picked up by the DSC module. The DSC module contains software for the purpose of calculating the speed changes and reporting the pressure loss to the driver via an illuminated indicator or symbol. The only additional components which are installed is the switch for system initialization. Early generation systems used a module which received wheel speed input from the DSC module.
- **Systems which monitor actual tire pressure** - These **"Direct"** systems will be referred to as Tire Pressure Monitoring Systems or TPM systems. TPM systems use wireless sensors which are part of the tire valve stem. These sensors monitor actual tire pressure and send this information to a module via multiple antennae. These systems are preferred due to the fact that the actual tire pressure is monitored rather than by variations in tire rotational speeds.

There is a simple way to identify the difference between the two systems. On systems which monitor actual tire pressure, the tire valve stem is threaded and has a "hex head" on the valve stem. The systems which monitor wheel speed have conventional rubber valve stems.



In 2000, there was much media attention surrounding tire safety issues. The leading tire manufacturers were involved with many law suits regarding catastrophic tire failures. These well publicized incidents involved injury and fatalities.

In response to these issues, the U.S. Congress enacted legislation Features and Technology the "Transportation Recall Enhancement, Accountability and Documentation (TREAD) Act in November of 2000.

The TREAD Act encompasses many aspects of tire industry issues. The act includes items such as tire labeling requirements, tire testing standards, information on tire safety related recalls etc. There are also provisions for issues on child safety restraints.

However, the focus of this training module is to train technicians about Tire Pressure Monitoring Systems (TPMS). TPM systems are also one of the primary components of the TREAD Act. TPM systems allow early detection of tire pressure loss which is not usually detected by the driver until vehicle handling and safety is affected.

The National Highway Traffic Safety Administration (NHTSA) is the government agency responsible for the creation and enforcement of the mandates of the TREAD Act. Initially, NHTSA approved the installation of "Indirect" TPM systems.

Indirect TPM systems monitor tire pressure "indirectly" by monitoring the rotational speed of the tire via the wheel speed sensors. The ABS/DSC system can then detect pressure loss by comparing wheel speed information between all 4 tires. Any loss in tire pressure would result in a change in tire diameter and therefore a change in rotational speed.

The guidelines of the TREAD Act found that "Indirect" TPM systems are ineffective in detecting tire pressure loss until the tire was under-inflated to an unsafe level. Therefore, NHTSA mandated that auto manufacturers install "Direct" TPM systems on all vehicles.

Direct TPM systems monitor tire pressure directly by using pressure sensors at each wheel which report tire pressure and temperature information to relevant vehicle systems. Tire pressure loss is then reported to the driver via an illuminated warning symbol. Direct TPM systems also offer the capability of monitoring tire pressure when the vehicle is at a standstill. Indirect systems must be driven in order to collect sufficient data to detect tire pressure loss.

As per NHTSA guidelines, passenger cars and light trucks must have the "Direct" TPM systems installed via a specific timeline from 2005. By 2007, all auto manufacturers must be in 100% compliance.

Aside from the obvious safety benefits, Direct TPM systems will also assist the driver by maintaining fuel economy and extending tire life.

This training module will help the technician to diagnose and repair both "Indirect" and "Direct" TPM systems. The first step in the diagnosis the these systems is identification.

NOTES PAGE

xDrive

BMW's "intelligent" all-wheel drive system was introduced on the E83 and E53 9/2003 production. It is now available on current all wheel drive versions of BMW models.

BMW caters to the needs of customers that desire vehicles with exceptional handling and performance while driving in snow/winter conditions by offering xDrive all-wheel drive.

Operation of xDrive:

- Driving torque is always transmitted to the rear wheels. At least 50% of the torque is always sent to the rear wheels.
- The portion of torque that is transmitted to the front wheels is achieved by a multi-disc clutch. This clutch assembly can be fully open, fully engaged or at any level of partial engagement in between. At full engagement the torque split to the front and rear wheels is exactly half.
- Engagement pressure on the multi-disc clutch is directed by an electronic control system in response to actual road and driving conditions.

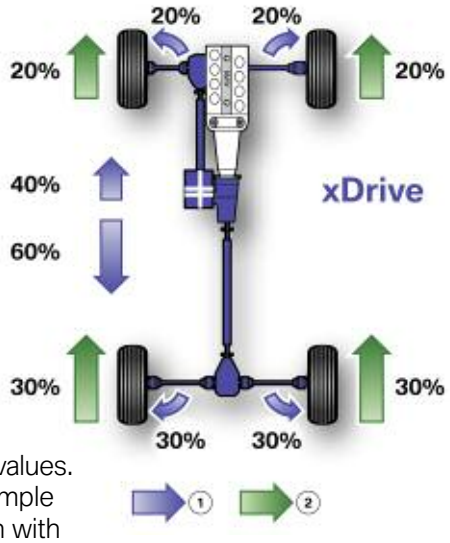
The purpose of xDrive is not just to optimize traction; it can also enhance both handing performance and stability on dry as well as slippery road surfaces.

Th xDrive system is incorporated in to the DSC logic. The DSC system utilizes the xDrive transfer case to compensate within physical limits for excessive oversteer and understeer. xDrive adjusts the front/rear torque distribution to avoid these tendencies.

If an oversteer condition is sensed, the multi-disc clutch engages, sending the maximum possible torque to the front wheels; thus making the vehicle take on front wheel drive characteristics.

If an understeer condition is detected, the clutch disengages completely, sending 0% of the driving torque to the front wheels.

Under normal operating conditions, the vehicle torque split is 60% rear and 40% front with few exceptions.



These are not fixed values. They are just an example of torque distribution with xDrive.

Dynamic Performance Control

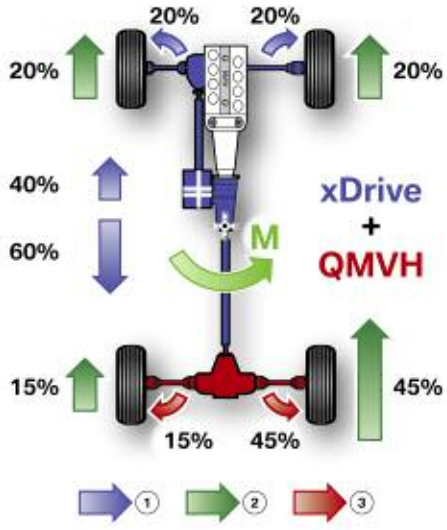
Introduced in the E71, Dynamic Performance Control (DPC) complements xDrive and Dynamic Stability Control, serving as an additional module to increase active safety and enhance the brilliant driving dynamics.

Dynamic Performance Control switches power between the left and right rear wheels to stabilize the vehicle within milliseconds and helps increase traction and lateral acceleration.

How Dynamic Performance Control works can best be described in canoeing terms: if you want to turn right when canoeing in the main current, you can brake using the paddle on the right side of the canoe. This is how most common electronic stability programs work. Alternatively, you could use the paddle powerfully on the left side of the canoe in order to have more control in progressing forwards and turning right. This is the principle behind Dynamic Performance Control.

DPC links the standard rear differential with a mechanical planetary gear set and an electronically controlled multi-plate clutch for each rear wheel. Its mechatronical system combines informatics, electronics and mechanics to process complex data such as the yaw rate, wheel speeds, steering angle and engine torque so that it can react immediately. When required, the system ensures that drive power distribution to the rear wheels can be freely varied and increased on either side as needed. The power distribution can also be displayed on the onboard computer.

DPC increases directional stability when accelerating out of bends and provides the driver with extra support when dealing with difficult driving conditions. Before under- or oversteer can take place, lateral guided force is used to keep the vehicle on track. Precise steering significantly increases driving comfort and safety.



These are not fixed values. They are just an example of torque distribution with xDrive & DPC

If the rear wheels are on different types of surfaces, DPC improves traction by supplying more drive power to the wheel with more grip. A wheel torque difference of up to 1,800 Nm can be actively created between the left and right rear wheels. This increases driving stability and allows for much faster acceleration.

Whereas xDrive variably controls the power distribution between the front and rear axles, Dynamic Performance Control intelligently distributes power between the two rear wheels. This results in precise handling whatever the driving conditions.

Dynamic Stability Control

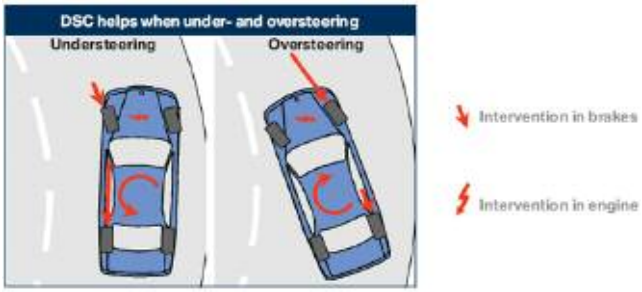
DSC encompasses three functions that aid in traction control:

- Anti-Lock Braking System (ABS)
- Automatic Stability Control (ASC)
- Dynamic Stability Control (DSC)

Features:

Dynamic Stability Control

Intervening in the engine and brakes, DSC prevents both under- and oversteering. Acting as a driver assistance system, DSC is made up of various modules ranging from proven ABS technology through DTC traction control all the way to the ADB automatic differential brake on xDrive equipped vehicles. Whenever required, each of these modules will intervene in the engine and brakes.



Traction Control

Controls engine power and the brakes to limit wheelspin and thereby improve the driver's control of the vehicle under conditions where a wheel or wheels might spin, primarily on slippery roads. The DSC system continually processes data from the wheel-speed sensors. Anytime a drive wheel begins to lose traction (rear wheels on most models, any wheel on AWD models), the system senses this and acts on the engine's throttle(s) or Valvetronic and ignition timing to reduce engine torque. It also acts on each brake individually as necessary to help bring wheelspin under control, enhancing driving stability on slippery surfaces (or even on dry roads under extreme acceleration or cornering).

BMW's traction control is an all-speed system. Engine intervention is possible at any speed.

Below 25 mph, the brakes are also applied selectively and separately as necessary to optimize traction very quickly. Between 25 and 50 mph, the rear brakes are applied as a pair. Above 50 mph, traction control operates entirely through engine intervention.

Dynamic Traction Control (DTC)

It has always been possible to de-activate Dynamic Stability Control functions (except antilock braking) via a console switch. In all RWD models except M models, a capability called Dynamic Traction Control is also incorporated.

DTC improves utilization of available road traction under specific conditions:

- on sand, gravel, deep snow or packed snow.
- climbing hills with deep or packed snow.
- when there is deep snow on only one side of the road.
- when driving with tire chains.

The driver may either fully de-activate DSC (except ABS) or activate the DTC mode. Dynamic Traction Control is selected via a brief push on the DSC console switch; full de-activation of DSC requires a longer (2 sec.) push on the switch. In the E65/E66 7 Series, DTC selection is via iDrive. Even with DSC de-activated, ABS always remains functional.

Electronic Brake Proportioning

Anytime the brakes are applied, a vehicle's front end becomes more heavily loaded; the rear "gets lighter." To deal with this, front to-rear proportioning of braking force is varied according to braking severity.

Via the wheel-speed sensors, EBP actually measures the slip at each wheel when the brakes are applied, and regulates pressure accordingly to the front and rear brakes. Braking force is thus apportioned optimally at all times, making best use of available braking traction at the tires and helping distribute brake and tire wear more evenly.

Antilock Braking (ABS)

During braking, anytime a wheel begins to lock up (slide), DSC releases and re-applies (cycles) the individual wheel brakes to prevent this from occurring. As only a rotating tire can deliver effective braking power to the road, the antilock function helps the driver achieve quick, controllable deceleration or stopping when necessary, helping avoid skidding.

Dynamic Brake Control (DBC)

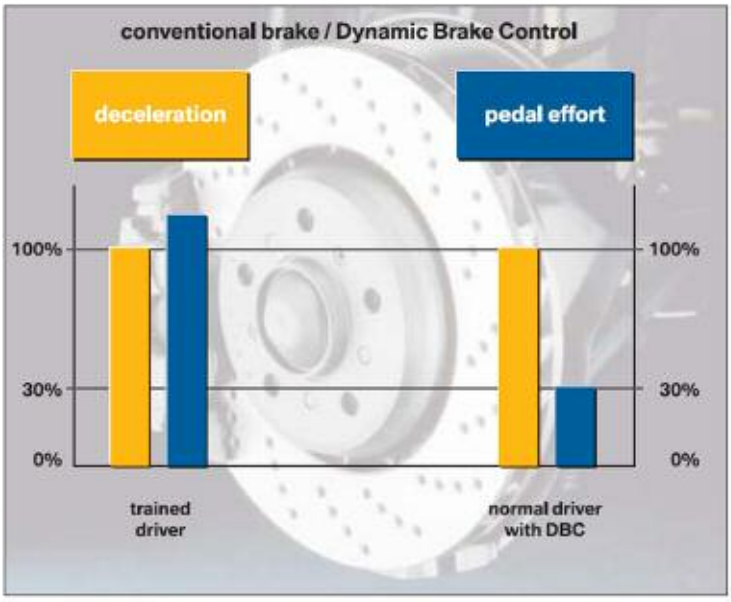
Reinforces the driver's brake-pedal effort in emergency braking. The system recognizes when the driver has made a "panic" brake application, and increases the level of assistance. By forcing the ABS to function optimally, this helps ensure that the most effective braking is achieved.

Cornering Brack Control (CBC)

Cornering stabilization. For this most sophisticated DSC function, the following inputs are employed:

- The wheel-speed sensors
- A steering-angle sensor (measures turning of the steering)
- A lateral-acceleration sensor (measures how "hard" the vehicle is cornering)
- A yaw sensor (measures the vehicle's rotation around its vertical axis)
- A brake-pressure sensor (informs the system of any application of the brakes by the driver)

Together, these sensors precisely measure the vehicle's cornering motion. With their inputs feeding into the powerful DSC microprocessor, the system detects any deviation from the normal cornering path (abnormal understeer or oversteer) and gently regulates the vehicle into a controlled situation.



The following key features appear in more than one BMW Series:

BMW features applies individual wheel brakes to help the driver keep the vehicle on the intended path. Thus in these critical situations, when the driver may be attempting a maneuver beyond the normal control range of the vehicle, he or she is more likely to retain control and avoid an accident.

Although it obviously affects the vehicle's handling, this function should be considered primarily a safety feature; in other words, it should not be interpreted as a feature that allows faster cornering or more abrupt maneuvers.

Hill Descent Control (AWD models only)
Helps the driver maintain speed and stability on steep downhill runs. The driver needs only to press a dedicated button on the console; HDC takes over, gently applying the brakes as necessary to keep the speed to a brisk walking pace.

Brake Fade Compensation
"Brake fade" is the loss of effectiveness when brakes heat up under hard use. When this occurs, a given degree of deceleration requires more pressure on the brake pedal. As brake temperature rises, Brake Fade Compensation automatically increases the hydraulic pressure in the brake system relative to pedal application, so the driver does not have to press harder on the pedal.

Brake Standby
When the driver lifts off the accelerator pedal abruptly, DSC recognizes that sharp braking may be about to occur and applies just enough pressure in the brake system to snug up the pads against the rotors. Thus when the driver's foot reaches the brake pedal, the short "time lag" normally resulting from bringing the pad to the rotor is eliminated. Actual braking sets in more quickly; the reduced stopping or deceleration distance could reduce the likelihood of an accident.

Brake Drying
Acting on input from the windshield wipers' rain sensor, the pads are periodically brought up to the rotors – just enough to eliminate any film of water between pads and rotors, but not enough to cause any brake application.

Comfort Stop/Soft Stop
Especially with automatic transmissions, unless the driver consciously eases off on the brake pedal, a jerk can occur as the vehicle comes to a stop. Comfort Stop automatically eases off, making for smoother stops.

Start-off Assistant
Similar in part to the 7 Series' Automatic Hold function, this function keeps the vehicle from rolling backward when stopped facing uphill. The driver can then start up without doing a ballet with the clutch, brake and accelerator (manual transmission) or doesn't have to hold the accelerator or brakes while stopped on a hill (automatic transmission).

M Differential

The main distinction between a conventional limited-slip differential and the M Variable Differential Lock is that where the former senses torque, the latter senses wheel speed (rpm). Under dry to not-quite-dry road conditions, the 25% limited-slip has traditionally enhanced the handling of sporty rear-wheel-drive BMW's; yet under slippery conditions, this differential type has limited ability to improve traction. In particular, this limitation applies when one wheel is on slippery, the other on firmer ground; it cannot transmit more torque than the slippery side permits.

On all current BMW models, electronic traction control (a function of Dynamic Stability Control, nearby) addresses this issue, although not in a manner conducive to sporty, M Car-style driving.

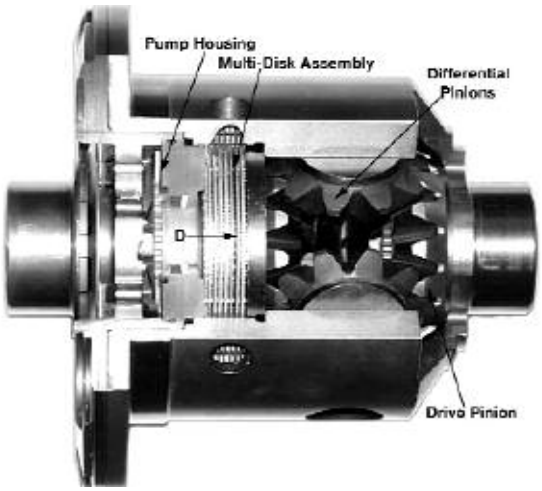
The M Variable Differential Lock specifically addresses low- and split-traction situations in a way that reinforces sporty handling, imparting to the M vehicles a slippery road ability no high-performance, rear-wheel-drive sports car ever before had.

Any time a speed difference develops between the two rear (driven) wheels, a shear pump, driven by this difference, develops pressure in the unit's silicon viscous fluid. This pressure is directed to a multi-disc clutch that transfers driving torque to the wheel with the better road grip ("select high"). The greater the speed difference between the two wheels, the harder the clutch engages. As this difference in wheel speeds diminishes, the clutch begins to ease off. In extreme cases, up to 100% of power can be channeled to the wheel with the better grip. In winter, this results in a significant boost to traction.

This mechanism accomplishes sophisticated action by entirely natural means. There is no external pump, no external source of lubrication or operating fluid. The very motion to be controlled – differences in speed between one wheel and the other – generates its locking action.

Viscous fluid is so-called because it develops internal force (via an increase in viscosity) whenever it is sheared; this is why the relatively small difference between one wheel speed and the other can generate the necessary action.

The variable M differential lock ensures that BMW M vehicles handle with remarkable sure-footedness and deliver excellent driving stability.

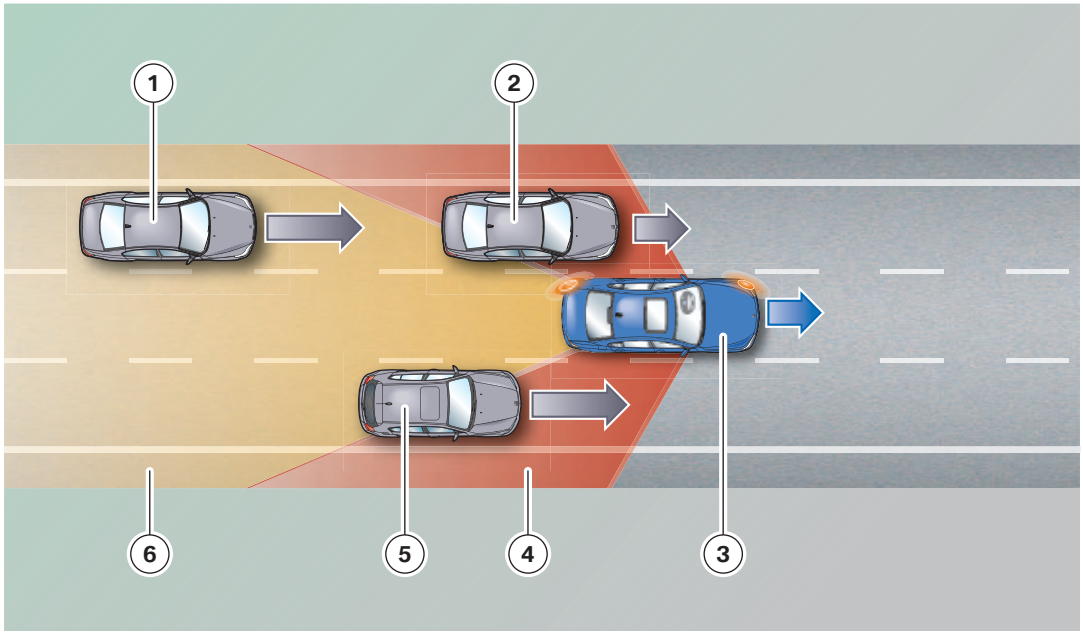


NOTES PAGE

Driver Assistance Systems

Active Blind Spot Detection

Active Blind Spot Detection is a new BMW system. It is being introduced for the first time in the F01/F02 7 Series . The system is designed to assist the driver in making lane change maneuvers by monitoring traffic at the rear and sides of the vehicle. Using two radar sensors it detects vehicles traveling in the rear and along side our vehicle and warns the driver of the position of any unseen vehicles around him traveling in his “Blind Spot”.



Index	Explanation
1	Fast approaching vehicle on the left-hand neighboring lane
2	Vehicle in the left-hand neighboring lane travelling at the same speed
3	Your own vehicle, with the intention of changing lanes to the left
4	Blind spot area (left/right)
5	Vehicle in the right-hand neighboring lane travelling at a faster speed
6	"Lane change zone"

KAFAS - Multifunction Video Camera

With the F01/F02, the customer is able to choose from a comprehensive range of optional driver assistance systems.

The individual systems and function units are becoming ever more densely networked as a result of the shared use of components and signals in some areas.

Depending on the combination of the available options installed, the functions in the F01/F02 are implemented as camera-based systems, both sharing the same camera and the one control unit, the KAFAS control unit.

KAFAS is the Camera Assisted Driver Assistance System.

KAFAS is used for the following combined functions:

- Lane departure warning
- High-beam assistant.

Lane Change Warning

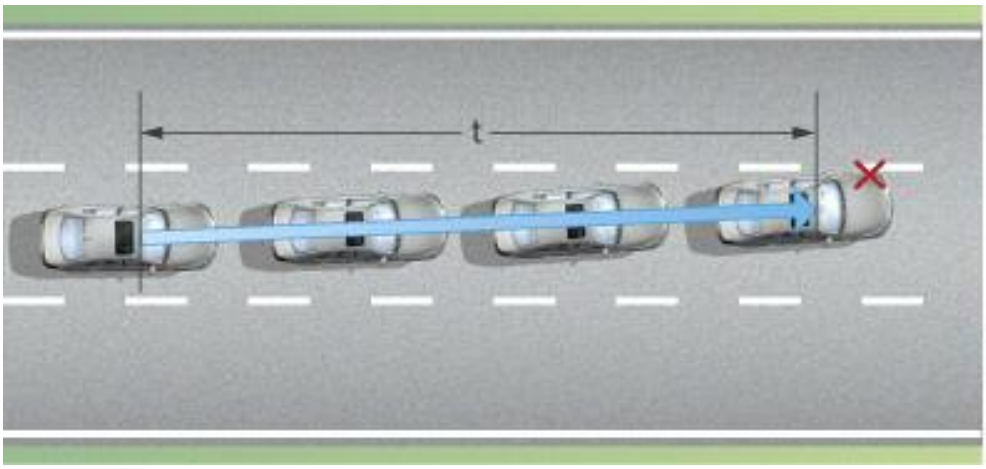
Keeping your attention on the road ahead: BMW's Lane Departure Warning recognizes when your BMW is straying from your lane, and gives you early warning with a discreet vibration of the steering wheel.

Lane Departure Warning is a driver assistance system that is based on a video sensor. A camera integrated near the rear-view mirror takes an image of the road ahead of your BMW during the day or within the headlight beam at night. This visual image is sent to a central control unit, where it is analyzed. The system identifies the lane markings, and tracks their position permanently. If the vehicle is threatening to stray outside the limits of the lane, the system alerts you by vibrating the steering wheel so you can correct the direction of your vehicle.

The system takes the vehicle's speed into account, providing a warning earlier when the vehicle is travelling at higher speeds, so the driver always has adequate time to correct the steering before the lane markings are crossed.

Lane Departure Warning is activated using a button on the multifunction steering wheel. It is intended primarily for use on freeways and highways, and becomes active at speeds of 70 km/h and above.

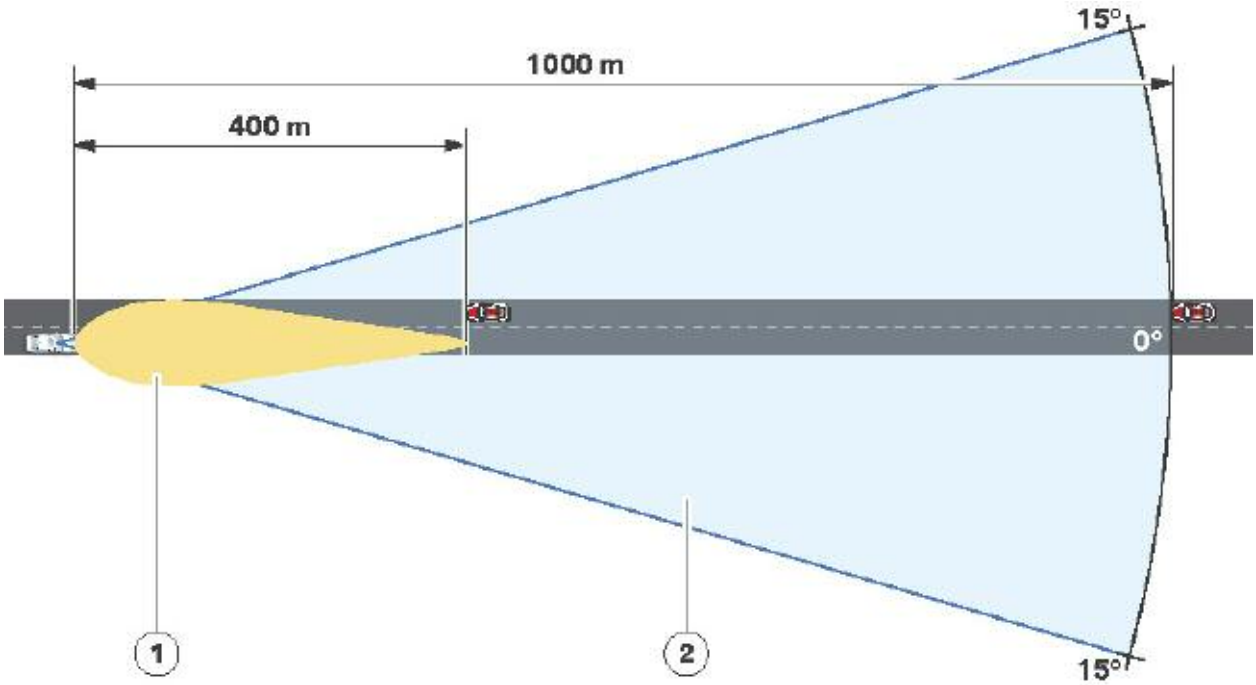
An icon on the Info Display (and Head-Up Display, depending on the model) displays if the system is on or off and if it has detected lane markings and is able to issue warnings. To preclude unnecessary warnings, the system is automatically deactivated in city traffic (at speeds below 70 km/h), construction areas and whenever the indicator is activated.



High-Beam Assistant

The video cameras monitor the area ahead of the vehicle for light sources. Vehicles travelling in front and oncoming traffic become recognizable at distances of up to approximately 400m/437yd. The detection range of the video camera is approximately 1,000m/1093yd. The video camera has a horizontal viewing angle of approximately 15° to the left and right and a vertical viewing angle of approximately 5° up and down.

When active, these special video cameras capture dots of light and, in the process, are able to distinguish between various parameters, e.g. light color and light intensity.



Index	Explanation	Index	Explanation
1	Recognition range	2	Detection range

Depending on the traffic situation, the prevailing ambient light conditions and which lights on the vehicle have been switched on, the high-beam headlights of the vehicle are switched on or off automatically by the footwell module at the request/activation recommendation of the KAFAS control unit.

Head-Up Display

The very name “Head-Up” describes the principle benefit of this system. The Head-up Display (HUD) projects a virtual image into the driver’s field of vision. Important information such as cruise control details or graphical directions from the navigation system are projected onto the windshield and are thus permanently visible within the driver’s field of view.

The driver of a BMW thus has the important data and graphics put up in his field of view, just like a pilot in his jet fighter.

The head-up display in the new BMW 7 Series incorporates various functions aimed at enhancing road safety and driver convenience.

That includes display of:

- Information from the cruise control system
- Information from the navigation system
- Check Control messages
- Road speed

Having the displays in the driver’s direct field of view increases safety, as the eyes are always on the traffic.

Head-up Display (HUD) in F01/F02

Night Vision

The BMW Night Vision 2 system provides the driver with a black-and-white image of the driving environment ahead of the vehicle in the control display CD or central information display CID.

BMW Night Vision 2 is a passive system without active infrared illumination. Objects situated ahead of the vehicle are shown in varying degrees of brightness depending on the temperature of these objects. This enables the driver to detect in good time heat-emitting objects such as, for example, persons, animals and other vehicles.

This thermal image is recorded with a Far Infrared camera (FIR) via a special imaging sensor which detects the infrared radiation in a specific wavelength range.

Intelligent algorithms in the control unit makes it possible to automatically detect persons in the image. Following evaluation of distance and direction of movement, a symbol on the central information display CID and in the head-up display HUD warns the driver of any persons at risk.

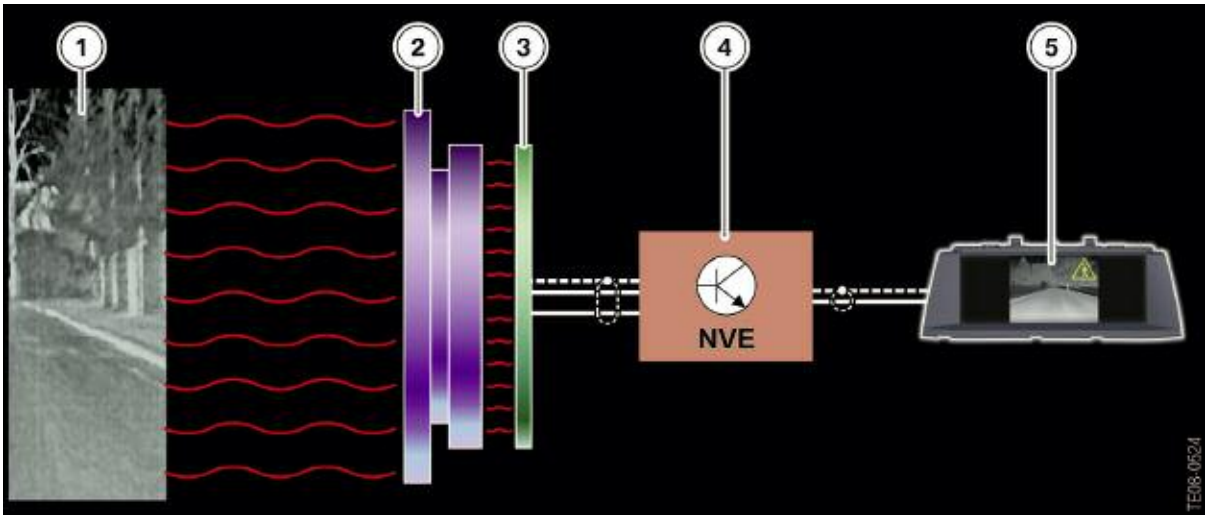
The BMW system is distinguished from infrared systems by its robust resistance to dazzling, its long range and its clearly structured image.

The system offers the customer the following advantages:

- Highlighting of non-illuminated, heat emitting objects such as pedestrians, cyclists, vehicles and animals.
- Better overview of the driving situation thanks to the depiction of the route of the road beyond the headlight cone.
- Improved vision in twilight (dawn/dusk) and darkness.
- Symbol warning of persons at risk in the area ahead of the vehicle.
- No dazzle in the screen image caused by the headlights of oncoming vehicles.
- Display of dark courtyard and garage entrances.

Night Vision 2 is designed as a supporting system, which, with a modified driving style, affords the driver a better overview of the road conditions ahead of the vehicle.

Note: The driving speed must be adapted to the relevant visibility conditions.



Index	Explanation	Index	Explanation
1	Environment ahead of vehicle	4	BMW Night Vision 2 control unit
2	Optical element	5	Control display
3	Thermal imaging sensor		

Comfort Access

Keyless Vehicle Access is possible with Comfort Access. This system allows the customer to unlock and open the vehicle without active use of the ID transmitter. Access to the vehicle can be gained from any point. It is important that the ID transmitter be located in the vehicle's immediate vicinity (approximately 5 feet). It is sufficient to have the ID transmitter somewhere on your person.

Comfort Access was first introduced on the E65 (03/2002). The system was then gradually introduced on other BMW models. It is currently available on the 1 Series, 3 Series, 5 Series, 6 Series, X5 and X6.

The benefits of Comfort Access are:

- High level of convenience when unlocking and locking the vehicle
- Convenient and fast access to the vehicle
- Simple engine start/stop procedure
- Maximum comfort for the driver
- No more annoying hunting for keys.

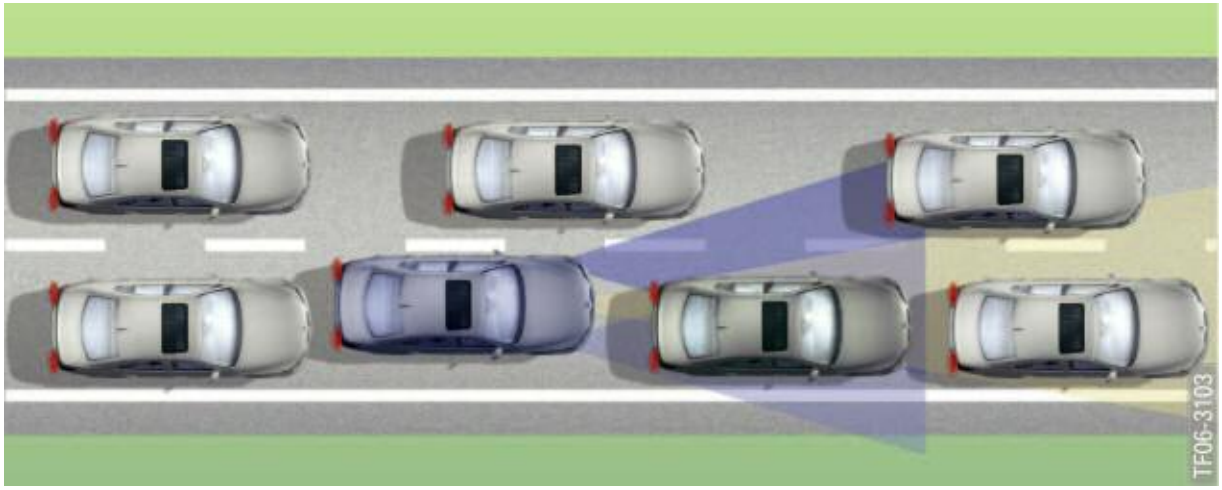
The vehicle is unlocked when you place your hand into the handle recess on the outside of the door and opened when you pull the door handle.

You can lock the vehicle again by subsequently pressing on the sensitive surface of the outside door handle.

The ID transmitter must be located in the vehicle interior in order for the engine to be started. The engine can now be started by pressing the START-STOP button and the vehicle is ready to be driven.

Active Cruise Control with Stop & Go Function

ACC Stop & Go extends the operating range of the former ACC system to include low speeds down to a standstill. In other words, speed and distance from the vehicle in front are automatically controlled at those speeds as well.

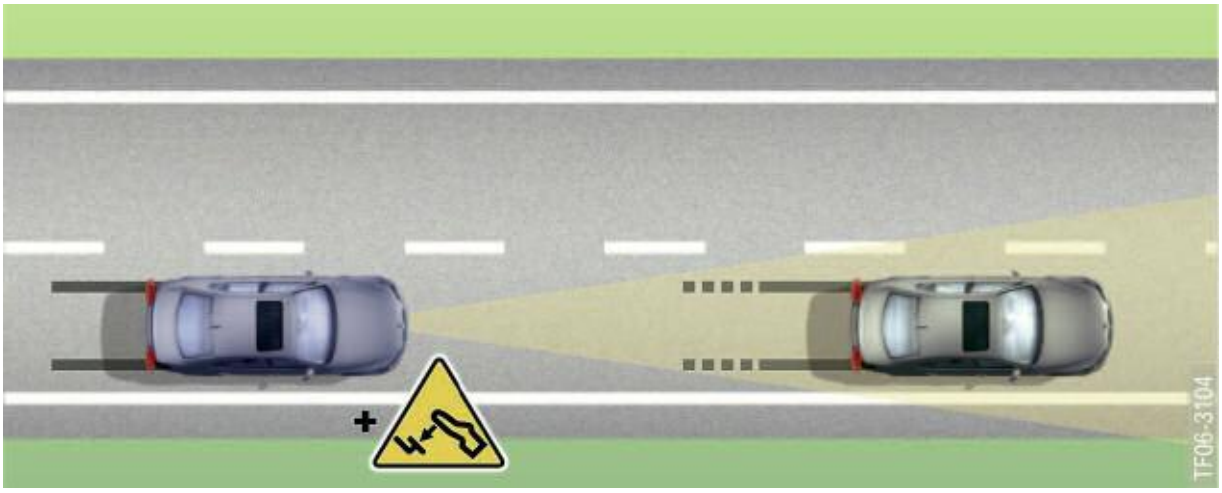


ACC Stop & Go will automatically stop the car if necessary and then indicate to the driver as soon as it detects that it is possible to start moving again. To pull away again, the driver has to acknowledge this message. The pulling-away process is controlled fully automatically by ACC Stop & Go only if the duration of the standstill is very short.

Thus, ACC Stop & Go provides optimum assistance for the driver not only in moving traffic but also in traffic jams such as are more and more frequently encountered on highways. However, this system (in common with ACC) is not intended for use in urban areas for negotiating junctions or traffic lights.

Adaptive Brake Assistant with Warning Function

This function is included automatically if the customer orders the ACC Stop & Go option, or in some countries, the ACC option.



Adaptive Braking Assistance offers the greatest benefit in situations where the vehicle is following another vehicle. If the vehicle in front brakes hard, it is detected by the long-range radar sensor. The two subfunctions of:

- precharging the brake system (also known as the “brake readiness” function) and
- lowering the threshold for the hydraulic Brake Assistant

assist the driver to perform the braking operation to best effect and thus in the best case to avoid a rear-end collision with the vehicle in front.

In the F01/F02, this function is no different from the function implemented in the E6x LCI. The long-range radar sensor gathers data on the road users ahead of the vehicle. The data are supplemented by data relating to the driving status of the customer’s vehicle, and both types of data are used as a basis for calculating a collision avoidance rate of deceleration. This is the rate of deceleration at which the driver would have to brake in order to avoid a collision with the vehicle in front. If the calculated collision avoidance deceleration is above a stored threshold value, the brake system begins to precharge and the activation threshold for the hydraulic Brake Assistant is reduced.

All sensor-related and processing functions of Adaptive Braking Assistance are computed in the long-range radar sensor. However, the computed output variables have to be transmitted to the DSC control unit because that is where they are put into action. To make this possible, the ICM control unit acts as a gateway between the local CAN and the FlexRay.

In the DSC control unit, there are still more conditions that need to be fulfilled before these two subfunctions can be carried out. (Example: road speed must be higher than a defined minimum speed.)

However, the Adaptive Braking Assistance technology also has limits and cannot react fast enough in situations such as other road users cutting in right in front of the vehicle. Driving with care and anticipation remains the fundamental imperative even with Adaptive Braking Assistance!

Note: The Adaptive Brake Assistant and its subfunctions , precharging the brake system and lowering the threshold for the hydraulic Brake Assistant are always active and does not have to be switched on separately by the driver.

Top View Camera

With the introduction of E70 M and E71 M the top rear side view camera (TRSVC) is available for the first time in the US market. Using two additional cameras in the outside mirrors, a virtual view of the vehicle from above is displayed in the central information display. When combined with PDC information and the rear view camera, the vehicle is monitored from all sides and the driver is warned both visually and acoustically of obstacles.

The cameras are located in the out side mirrors (see arrow in the graphic). The mirror mounting carriers are specially adapted to accommodate the LVDS cable of the camera system.

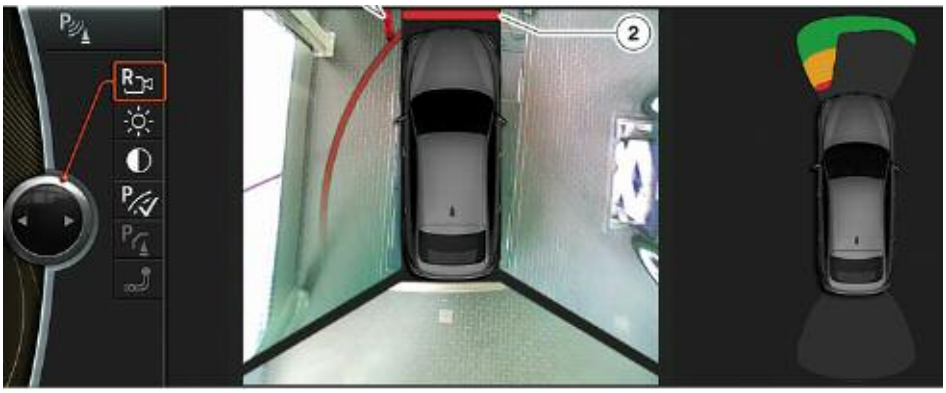
The cameras are located in the out side mirrors (see arrow in the graphic). The mirror mounting carriers are specially adapted to accommodate the LVDS cable of the camera system.

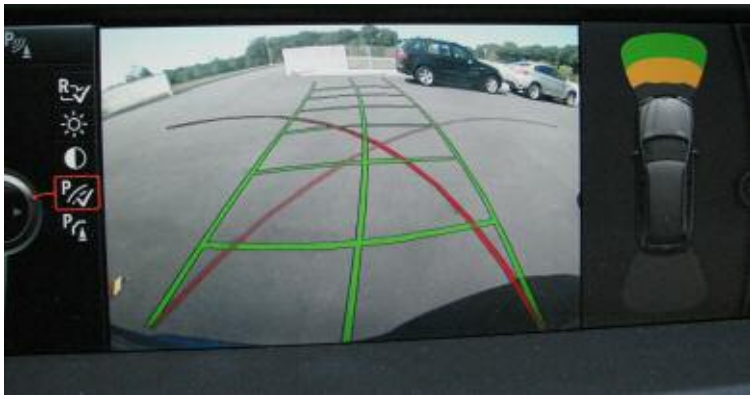
The Top view cameras are connected to the TRSVC control unit and work in conjunction with the rear view camera and Park Distance Control (PDC). They can be turned on by pressing the PDC button or are automatically turned on when the vehicle is placed in reverse.

The top view cameras have the same adjustment options as the rear view camera.

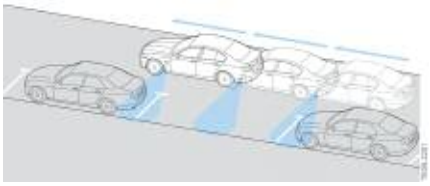
Parking aid line assistance is available for the top view camera and can be selected from the top/rear view menu screen (See lower left graphic).

The customer can choose between a “three way split view” that displays left, right and rear views in one image or the single view by selecting just the rear view camera image to be displayed in the CID.



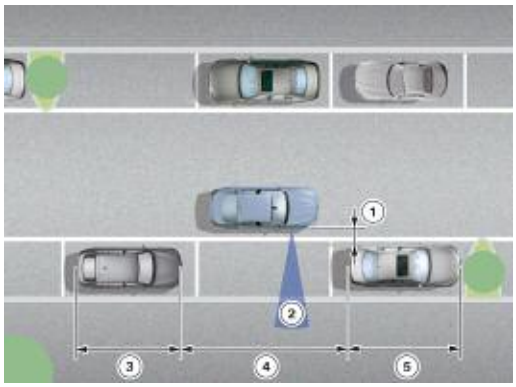


Parking Assistance



For the first time in a BMW vehicle, a system is being introduced in the F10 that assists the driver when performing a parallel parking maneuver. Parking assistance is available as optional equipment (option 5DP) in conjunction with the optional Park Distance Control (option 508).

Parking assistance makes it easier to maneuver the vehicle into parking spaces parallel to the roadway. The system measures potential parking spaces when driving by them at speeds less than 35 km/h, regardless of whether parking assistance has been activated or not. When a parking space 1.2m larger than the vehicle length is detected and the system has been activated, the space is shown to the driver in the central information display (CID). The driver remains responsible for the acceleration and braking of the vehicle. The parking assistance system only takes over the steering function and the PDC monitors the distances and obstacles. The driver is led through the parallel parking process with detailed instructions for action displayed on the CID and, where applicable, additional acoustic warnings and acknowledgements are issued.



Index	Explanation
1	Maximum distance to the row of parked vehicles: 1.5m
2	Horizontal opening angle of the ultrasonic sensor: ± 10°, range approximately 4.5m
3	Vehicle or object length at least 1.5m
4	Length of the parking space, vehicle length plus approximately 1.2m
5	Vehicle or object length at least 1.5m

iDrive Concept

Contemporary automobiles and particularly contemporary luxury automobiles – pose an ever-growing challenge to their designers: how to accommodate the extensive functions that modern technology offers without overwhelming the driver and creating a driving environment cluttered with controls.

iDrive is BMW's solution to this challenge. BMW has applied the Navigation System's proven concept: a color monitor with control menus, and a controller.

More functions than ever are controlled in this manner, and the controller has migrated from the monitor panel to a central position between the front seats. This controller acts like a "fixed position mouse" that controls the menus located in the control display or central information display (vehicle dependent). The controller is equally accessible to the driver and front passenger, and is finished in satin aluminum.

There are two different versions of the controller.

- One controller includes force feedback: According to the functions it is controlling, it gives the user an appropriate tactile feedback.
- The other controller has fixed notches and provides no force feedback. It's operation of the CD/CID is the same.

Display, Operating and Control Concept

With the new BMW 7 Series F01/F02, a new operating and control concept is being introduced at BMW. In addition to the main menu, there is an arrangement of four direct access buttons, a Back button and an Option button in the immediate vicinity of the controller.

Display, operating and control concept BMW 7 Series F01/F02

Index	Explanation
1	Head-up display (HUD)
2	Instrument cluster
3	Central Information Display (CID)
4	Favorite buttons for individual assignment
5	Controller
6	Gear selector switch (GWS)
7	Steering column stalk/steering wheel
8	Operating unit for driver assistance systems (BEFAS)

Body Electronics

Bluetooth

Bluetooth technology uses radio frequencies, instead of wires, to connect various electronic devices to each other. This allows you to connect your computer, keyboard and mouse; share addresses between your PDA & laptop, and send music from your MP3 player to your wireless headphones. This versatile feature can also wirelessly connect compatible mobile phones to vehicles for hands-free calling. With a Bluetooth mobile phone, drivers can make and answer calls, as well as browse and select phone book entries, just by using the multifunction steering wheel controls and radio keys. For more information please visit www.wireless4bmw.com

Do I need to add a special antenna or cradle for Bluetooth and what is the range for staying connected between the phone and the vehicle?

New BMW's that come factory-installed with Bluetooth capability do not require a special cradle. The phone can be kept in your vehicle's glove box, trunk or even in your pocket – anywhere within a 30-foot radius of the vehicle, depending on the power of your Bluetooth device, signal interference, or objects that might be between the phone and the vehicle's Bluetooth antenna.. Please note that docking cradles providing phone security, battery charging and improved antenna connection are available for selected phone models.

Certain 2003 and 2004 BMW's can be retrofitted with Bluetooth as a BMW center-installed accessory. This requires using a special, console cradle. For costs and more details, see your BMW center.

Can I access my mobile phone phonebook entries in the vehicle?

After the initial pairing procedure is completed, your phonebook contacts will automatically download to the vehicle's hands-free system. Any changes you make in your phone's phonebook will be automatically updated in the vehicle when the phone connects to the hands-free system. If more than one phone is paired to the vehicle, individual phonebook information will be used for each phone. For added protection, the contact information will only be available in the vehicle when the phone is connected to the hands-free system.

How secure is the Bluetooth connection between my mobile phone and the vehicle?

To protect your privacy, the BMW Bluetooth hands-free system requires a Bluetooth Passkey code to pair a mobile phone. This Bluetooth Passkey must be entered only once during the initial pairing procedure. To reduce the risk of interference or interception, Bluetooth wireless technology hops communication frequencies 1,600 times per second. In addition, BMW provides encryption to further protect the privacy of your calls.

Digital Radio Sources

HD Radio
Pure Digital. Clear Radio.

BMW Group introduced HD Radio Technology developed by the iBiquity Digital Corporation starting with the 9/2005 production 7 Series.

iBiquity Digital is the sole developer of HD Radio technology. This technology is approved by the FCC for the US market. This company does not actually produce radios nor audio equipment. They are responsible for licensing this technology for use in the radio industry.

The benefits to digital radio are:

- AM will sound like present day FM
- FM will have compact-disc-like quality
- Improved Fidelity
- Free programming (only cost is for IBOC receiver)
- Supplemental Program Services (SPS) - Station ID, Features and technology, Artist, Album, Genre, etc.
- Improved Reception (depending on digital data received)
- Analog to Digital (Digital to Analog) switching depending on reception quality
- From March 2007 Multicasting is available on some models

The HD Radio technology used in our IBOC control unit practically transparent to the user in terms of tuning.

IBOC is the acronym for In-Band On-Channel. This signifies that the location for the digital radio signals can be found in the exact same location on the “dial” as the analog signals. FM101.1 in the “analog realm” is also FM101.1 in the “digital realm.”

Initially, radio station broadcasting with iBiquity Digital’s HD Radio technology broadcasts two signals in the same frequency range. One signal is analog with an 8 second delay and the other is digital. This is known as “Hybrid Mode.”

Eventually the radio stations will stop transmitting in “Hybrid Mode” and will go to purely digital. The time frame is not yet established.

Sirius Satellite Radio

BMW offers our customers the latest in radio technology. The 3, 5, 6 and 7 Series can be factory equipped with the system; these models are also available with factory preparation for SIRIUS installation by BMW Centers.

SIRIUS delivers 120 channels of the best in digital entertainment coast-to-coast. 65 of these channels are 100% commercial-free music, featuring multiple categories as widely varied as hip-hop and classical. 50 further channels are devoted to news, sports and entertainment from content partners such as NASCAR, ESPN, Fox News, NPR, CNN Headline News and Radio Disney. And as the official Satellite Radio Partner of the NFL, SIRIUS leads in live sports on satellite radio, offering the entire NFL every week and up to 40 live NHL games per week.

SIRIUS channels are delivered by three powerful satellites for seamless coverage anywhere in the continental U.S., and optimized for superior sound resolution by proprietary S>PLEX technology.

Hardware for the vehicle consists of:

- a SIRIUS Satellite Receiver
- a Satellite Antenna
- a SIRIUS-compatible audio system

Once the equipment is installed and activated, the customer simply selects the satellite radio mode (example: AM/FM/CD/Satellite). As with FM and AM, users will be able to scan and set their favorite presets. The audio display can show the channel name, channel number and (in the case of music channels) artists and music Features and Technology.

BMW ASSIST

The BMW Assist system incorporates an integrated wireless telephone with advanced digital and analog service plus a Global Positioning System (GPS) satellite receiver to determine your vehicle's location. Combined, they enable BMW Assist to enhance the BMW driving experience.

With BMW Assist, the customer will feel prepared and protected 24 hours a day, 7 days a week in the case of situations they may find.

The features of ASSIST can be broken down into three main categories:

- Safety Plan (core program)
- Convenience Services (optional; requires Safety Plan)
- Options

Safety Plan
(Standard on 2007 5, 6, & 7 Series and with option code 639)

To make a safety service request simply press the “SOS” button. This transmits the vehicle location and information. A specialist responds via the hands-free telephone system to coordinate the best course of action for your situation and notify emergency services.

The vehicle will attempt to call BMW Assist automatically in the event of a serious accident.

If the vehicle ever gets stolen, the BMW Assist service can help the police locate it. This feature may save the customer money on their insurance premium, as well as give peace of mind.

Automatic Collision Notification

The BMW Assist system transmits the vehicle’s current location and vehicle information to the BMW Assist Response Center automatically after an airbag deploys or a severe rear impact occurs. A trained response specialist will then attempt to contact the vehicle via the hands-free telephone system, and will notify the appropriate emergency services of the location and situation, even if response is not returned to the operator/specialist.

Emergency Request (SOS)

By activating “Emergency” on the control display or pressing the “SOS” button, you transmit your location and vehicle information. A BMW Assist response specialist then speaks with you to determine the nature of your emergency and to coordinate the response to your specific assistance needs. The specialist can direct emergency services to your vehicle's location, provide you with emergency directions to the nearest hospital or police station, and even notify your emergency contacts about your situation.

Enhanced Roadside Assistance

If you experience a flat tire, run out of gas, or need any other roadside help for your vehicle, just press the “Wrench” or “Roadside Assistance” button to transmit your location and vehicle information. The BMW Assist Response Center then links you to BMW Roadside Assistance for the appropriate dispatch to your location, even if you don't know where you are.

MyInfo

MyInfo allows you to send business listings and street addresses with associated phone numbers from the comfort of your home or office directly to your BMW. To use MyInfo, just search for a business or street address at Google Maps™; add a personal note, if desired, and click “Send.” The destination will then appear in your BMW under the “MyInfo” menu option and can be exported to your Navigation system (if so equipped) for immediate route guidance, while you can call the destination via your Bluetooth linked phone.

MyInfo is available on 2008 and later X6 produced 4/08 and later, and on all other 2009 and later BMW models, except the X3 SAV.

Door Unlock

This helpful feature allows you to gain access to your BMW if you’re ever locked out. Simply call BMW Assist, provide your name and password, and a response specialist will send a signal to your vehicle to unlock the driver’s door.

Stolen Vehicle Recovery (7 Series from 9/2005; 5/6 & Other Series from 10/04)

If the BMW is equipped with this capability and is ever stolen, the BMW Assist Response Center can be notified by calling toll free (888) 333-6118 immediately after filing the police report.

The center can remotely activate the BMW Assist system to locate the vehicle and help the police recover it.

TeleService
(5, 6, & 7 Series from 2004, 3 Series from 2007)

The vehicle's service condition (condition based service) is transmitted automatically or the customer's request to the preferred BMW center. The customer's service advisor will then call the subscriber to set up a convenient appointment.

Customer Relations

For questions, compliments or concerns, The BMW Customer Relations department can be reached by pressing the ASSIST button or selecting customer relations from the CD/CID iDrive Menu.

7 Series drivers can also easily contact their preferred BMW center.

Convenience Plan

For an addition yearly rate, the BMW ASSIST Safety Plan can be Upgraded to include the Convenience Plan.

A personal concierge is available to assist with business or personal arrangements such as making hotel or dinner reservations, buying event tickets, or even finding that perfect gift.

Directions

Pressing the "SOS" button allows the customer to contact a navigation specialist for step by step directions to a desired street address or point of interest.

If the vehicle is equipped with the iDrive based navigation system, the address and number of the location desired can be automatically downloaded to the vehicle.

Critical Calling

This feature allows the customer to place up to 4 operator assisted calls a year (five minute maximum allowable time). This feature is excellent in case the customer forgets their mobile phone but needs to make an urgent call to a family member or colleague.

Traffic

Up to-date traffic reports along the route can be obtained as well as the weather forecast locally or at the destination.

Weather

The BMW ASSIST operator can also help with the weather forecast of your desired destination.

Optional Services

Make hands-free personal calls with the BMW handset or an approved *Bluetooth®* phone.

Hands-free Personal Calling

Using an approved *Bluetooth®* cellular phone will allow the customer to call hands-free without any cords or cables getting in their way. The phone will completely integrate with the vehicle's electrical system.

Concierge

This feature takes advantage of BMW Assist Concierge and utilize BMW's expert resources for travel arrangements, service referrals, shopping, entertainment, business outings and much more. BMW Assist Concierge addresses needs in many areas in life, not just those related to the driving experience.

The concierge service is part of the Convenience Plan and can be used at any time, from anywhere by dialing toll-free (800) 233-8896 or via http://concierge.bmwassist.com.

BMW Search

BMW Search allows online access to up-to-date fuel prices and the latest weather forecasts, as well as stock indices from Bloomberg and the powerful reach of the Google Maps™ database – all delivered to the iDrive display right inside your vehicle.

NOTES PAGE