the bimmer pub

Volume 1 Number 1 March 2012

Technical Knowledge for Independent BMW Service Professionals

Headlights **04** Airbags **14** Power Seats **22** Four Wheel Drive **28**

Welcome.

'the bimmer pub' is sponsored by your local BMW wholesaling dealer parts department, and is dedicated specifically to independent technicians who service BMW vehicles.

Our position is simple. If you are able to repair and maintain BMW vehicles properly and efficiently, your reputation will be enhanced, as well as the reputation of BMW. To this end, feature articles are intended to provide hands-on diagnostic and repair procedures, service and maintenance techniques, with content sourced from both BMW and successful independent BMW repair specialists.

With a driving combination of the proper repair procedures and the correct Original BMW replacement parts, you can expect to fix that BMW right the first time, on time, every time.

Included in this effort is the development of a highly informative and user-friendly web site that will be home to article archives and more. We expect to launch the new bimmer pub website during the third quarter 2012.

We want to make "the bimmer pub" the most useful and interesting technical magazine you receive, and you can help us do that. Please email our publisher at: cayers@thebimmerpub.com and let us know what topics you would like to see covered in upcoming issues. Your suggestions and comments are welcome, and with your involvement, this publication can become one of your most important tools.

Thanks for your continued interest.

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Cover Photo:
The BMW 5 Series Sedan,
Adaptive Headlights

Contents

04 Headlights: Lighting the way

Safety is a top priority at BMW. One area the company always wants to enhance is the driver's night-time vision. Here are some of the many ways BMW has improved its lighting systems to improve safety on the road for everyone.

14 Airbags: Cushioning the blow

Among the greatest safety advancements are BMW's various types of supplemental restraint systems. Dual front air bags, side curtain safety bags and belt tensioning devices are only some of the life-saving features found on BMW vehicles. Here are some service procedures you should know about.

22 Power Seats: You may now be seated

As far back as the early nineties, BMW offered memory seating, marking a new application for electronic control units. While these systems have become more complex, service procedures remain straightforward.

28 4WD: Power Distribution

Getting all that awesome BMW power to the ground is no easy task. The 4WD BMW X5 has been around for a decade now, and a few years ago BMW introduced a 4WD 3 Series sedan. Let's look at how these systems work.

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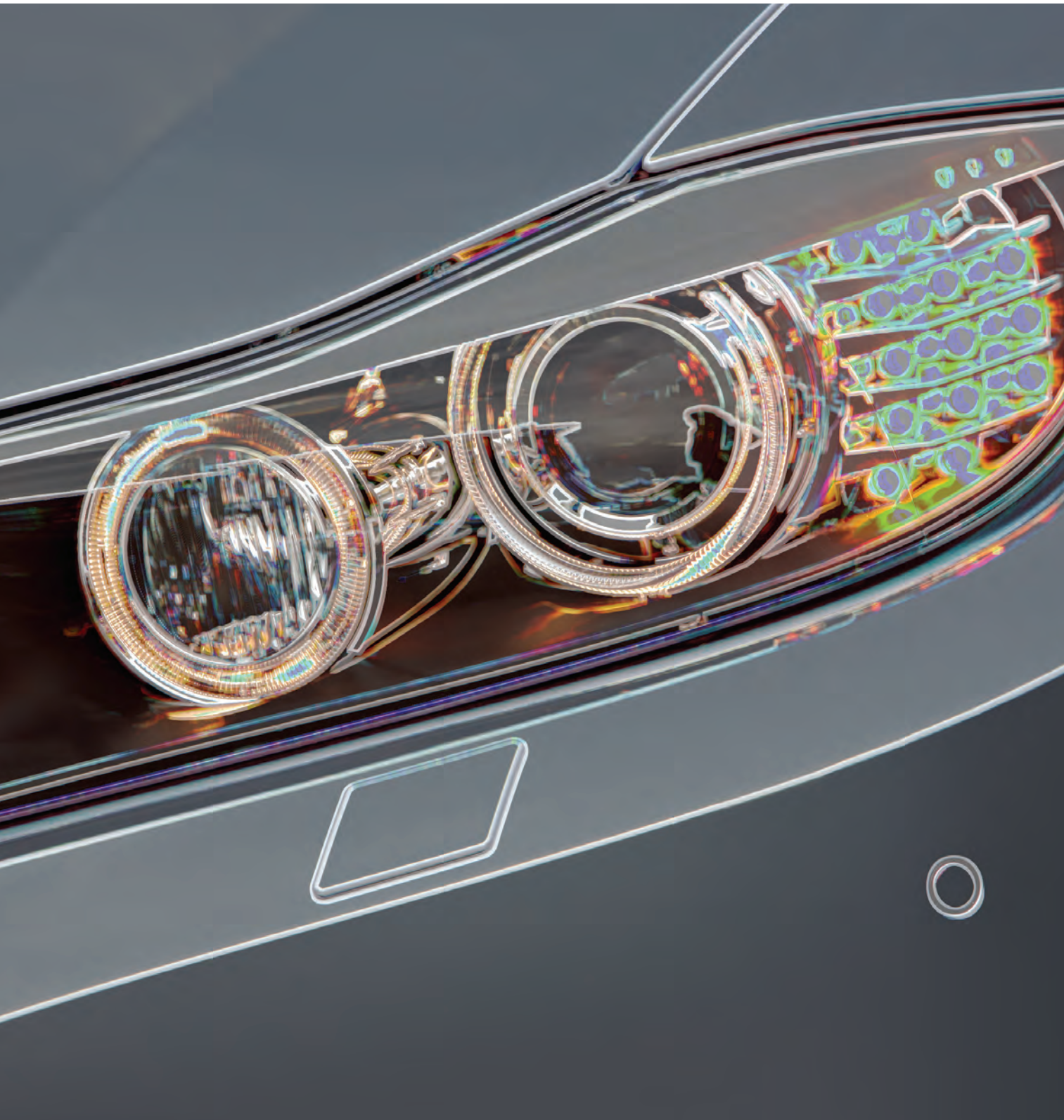
Lighting the way

Safety is a top priority at BMW. One area the company always wants to
ways BMW has improved its lighting systems to enhance safety on the



enhance is the driver's night-time vision. Here are some of the many
road for everyone.

BMW has made many improvements in all of its safety systems over the years, including three-point seat belts, crumple zones and, of course, Supplemental Inflatable Restraints (Air bags). These are all incredible systems that react to impacts within milliseconds . Three-point seat belts have proved to be the most effective and convenient means of keeping the passengers safely seated upright. Crumple zones absorb significant amounts of energy from the impact, maintaining a protective cocoon around the passenger compartment. Supplemental Inflatable Restraints gradually decelerate the body during severe impacts. All of these components and systems result in a vehicle that is safer for all occupants. Some of these technologies are passive, like crumple zones and air bags, and some, like seat belts, require action on the part of the occupant. But all of them make BMWs some of the safest vehicles on the road.

Of course, the best accident is no accident at all. So, BMW empowers drivers with precision handling, a well-balanced machine, and superior braking to enable them to take aggressive evasive action when necessary. This proactive approach to promoting accident avoidance involves giving drivers the proper tools so they can get themselves out of harm's way.

Look at the shape of the lens and you will see a smaller lens within a larger one. This tells us that these are HID Xenon headlights. If a headlight is inoperative, be sure to check bulbs and fuses before looking into more involved components, such as control units.

But even more essential is the ability of a driver to see what's ahead in time to deal with it even at high speeds. One of the many ways this is accomplished is with intelligent headlight systems. Conventional headlights do not shed enough light as the vehicle climbs and descends hills, and motors around corners. Recent advancements such as Xenon bulbs, focused beams, and vertical directional headlights all offer a clearer view of the road ahead, especially while cresting hills and rounding corners. All we have to do is keep these systems working.

Turn On The Lights

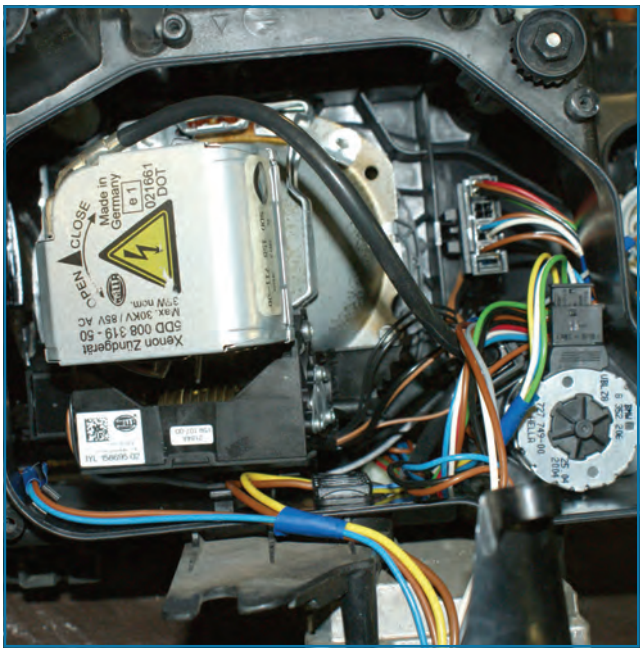
Starting in the late '90s BMW introduced advanced controls for vehicles with Xenon headlights. These intelligent headlights do more than provide light. They also control two aspects of the beam. One is the "throw" or focus of the light beam, and the second is the "height" or vertical angle relative to the road. Both features allow you to see farther down the road. To diagnose and repair this system you need to be familiar with all of the components involved, including the beam's height control, which is optional.

The Brains

The brain of the system is the lighting module. On early versions, the module receives inputs from the various light switches and, in most cases, supplies power directly to individual bulbs. The light switch is not the only input, though. The brake, hazard, turn signal, fog lamp and high beam switches also send signals. Even the interior light dimmer is attached to the lighting module. The sole exception is the reverse light switch input. This signal goes directly to the instrument cluster and is then passed on to the lighting module through the I-Bus. The K-Bus also sends signal inputs to the lighting module for various functions.

The lighting module is in control of all exterior lamps including low beams, high beams, parking or tail lights, brake lights with high-mounted stop lamp, marker lamps, fog lamps, license plate lamps, and reverse lights. The lighting module also controls the instrument cluster lighting by receiving signals from the dimmer switch and providing variable voltage to the instrument panel for illumination. This function also controls the interior lights for switch illumination. The GEM (General Electric Module) is in control of all the other interior lights. For instrument cluster-mounted indicator lights,

Continued on page 8



Take a look at the back of a headlight unit with the covers removed and you can see all of the components. On this Gen III assembly, the unit on the bulb is the igniter. Just below it is the non-serviceable beam focus motor. The round motor to the right is the serviceable vertical motor.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Fuel System.

On the underside of this Gen III system you can see two control units. The larger one is the Xenon control unit for lighting. The smaller unit is the widening control module for headlight focus control and aiming.

such as turn signal and hazard indicators, the cluster supplies the power and ground. The instrument cluster receives commands for these various lighting functions through the I-bus from the lighting module.

The lighting module can determine if a bulb is out. It informs the instrument cluster, and the appropriate failure message is displayed to warn the driver. Keep in mind, since not every vehicle has fog lights, the lighting control module is coded for the specific vehicle in which it is installed . When replacing a lighting module you must code it to the vehicle with iComm through BMW's website www.bmwtechinfo.com. You can upload the existing coding from the old module and download it to the new one. Or, if you cannot communicate with the old lighting module, you can select which features to turn on individually, but you will need to know what options the vehicle came with. If, after replacing the module, you find that some features do not work, it could be because the lighting module has not been coded properly.

Are Others Involved?

With BMW's sophisticated lighting systems comes added complexity. The additional features are headlight widening (referred to as LWR) and Electronic Height Control (referred to as EHC). There is a single headlight widening module controlling both features for both headlight assemblies.. The headlight widening control module is connected to the instrument cluster through the K-Bus. It is discretely wired to the lighting control module so it knows when the headlights are on. An additional discrete input is a speed sensor signal. The control unit monitors inputs from both the lighting module and

Continued on page 10


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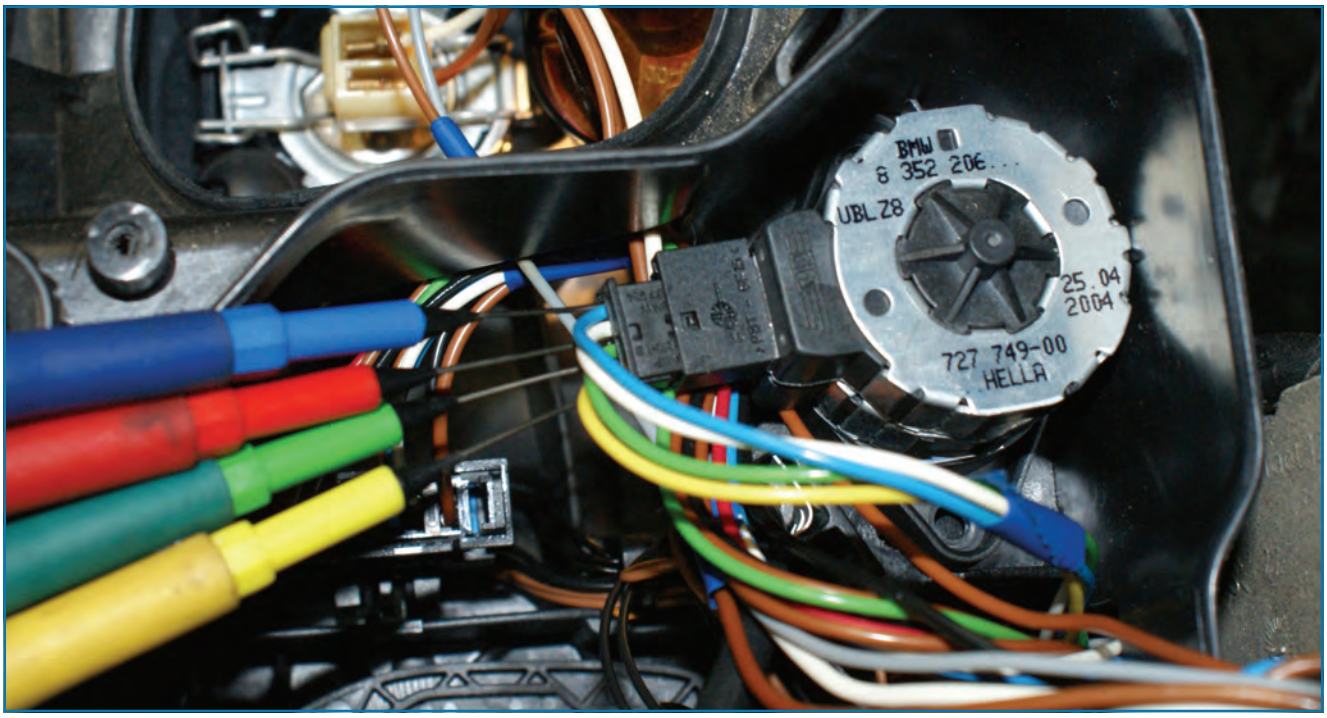


You can monitor the command to the stepper motor while starting the engine and turning on the headlights. While it is nice to scope all four commands at once, you can also monitor each motor command individually with a DMM.

K-Bus lines and varies output signals accordingly. Since a control unit is in charge of these lighting features, self-diagnostic functions are available, but remember that the lights have to be on while connecting your iComm or a generic equivalent.

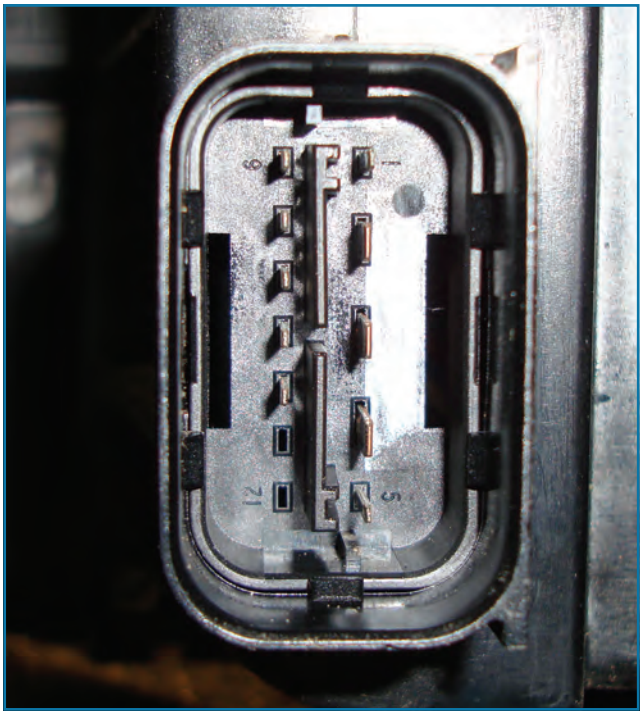
Headlight beam width (range) and level position are determined by the headlight-on command, and vehicle attitude, and speed. As we mentioned earlier, the lighting module sends power to the headlight widening control unit. Once powered up, the unit looks directly at the level sensors. One sensor is mounted on the front suspension link and one is mounted on the rear suspension link. From these sensors the headlight widening control unit can determine if the headlights are pointing towards the sky on an ascent, or down at the ground on a descent. The vehicle speed input is another discretely-wired input to the control unit from the ASB/DSC control unit. Typically, one speed sensor, which is usually located at the passenger's side front wheel, is the speed signal sent out of the ABS/DSC and used for the vehicle speed input.

Now let's look at some outputs. The level and focus of the headlight beams are all controlled by stepper motors. These stepper motors are directly controlled by the module. They are four-wire motors. Two wires make up one coil, and the other two are for the second coil. One stepper motor controls the focus of the beam and the other controls the height of the beam. Stepper motors offer very small adjustment increments so there is precise control of the focus and level of the beams. Both left and right stepper motors are controlled together. To ensure that they are

Continued on page 12


BMW Group
Fuel System Cleaner
Helps lower emissions

properly synchronized, they are commanded from one stop to the other every time the key and the headlights are turned on. These stepper motors are mounted in the headlight assembly, so they are not easily seen. The vertical adjustment stepper motor is serviceable, but the focus control motor is not. So, if your diagnosis shows that the focus control motor is faulty, you will have to replace the entire headlight assembly. In newer Gen III systems the stepper motors for focus are controlled directly by the widening control module. On vehicles with the "Automatic" feature, such as the 2003 X5 (E53 chassis), the lighting module controls the beam's focus.



While you may not have all of the factory cables needed to test the assembly, you can still monitor the power supply voltage and ground to the control units at the headlight assembly connector. Simple checks like these are often overlooked, yet can provide the needed solution.

To Be Or Not To Be . . . with Xenon Headlights

BMW started offering Xenon (HID) headlights on the 750iL (E32 chassis) in the 1993 model year. Of course, the lighting control module is in charge of turning the lights on, but the signal is sent first to the Xenon headlight control unit, which directly powers up the bulb. It is difficult and unsafe to test voltages directly at the Xenon bulb. The voltage spikes to between 18,000 and 25,000 volts to jump across the gap in the bulb. DMMs (Digital Multi-Meters) and their test leads cannot handle voltages that high. There are high-voltage probes for conventional meters that are commercially available that can handle up to 40kV, but this type of testing is not recommended.

For the early Generation I HID units ending in the late '90s there is a specific cable to be used with the GT1's measurement system. Generation III uses a different cable and you can use an inductive ammeter to measure the current draw of the system. Since you may not have these tools available, you are limited to testing power supply and ground circuits at the headlight assemblies. However, you can scope the stepper motor control wires inside the headlight housing.

In Conclusion

Just knowing how something works is half the battle. Many of the inputs can be monitored with an iComm or aftermarket equivalent. The outputs can be bi-directionally controlled as well. With a combination of scan tool and electrical testing you should be able to keep most repairs accurate and profitable. ●

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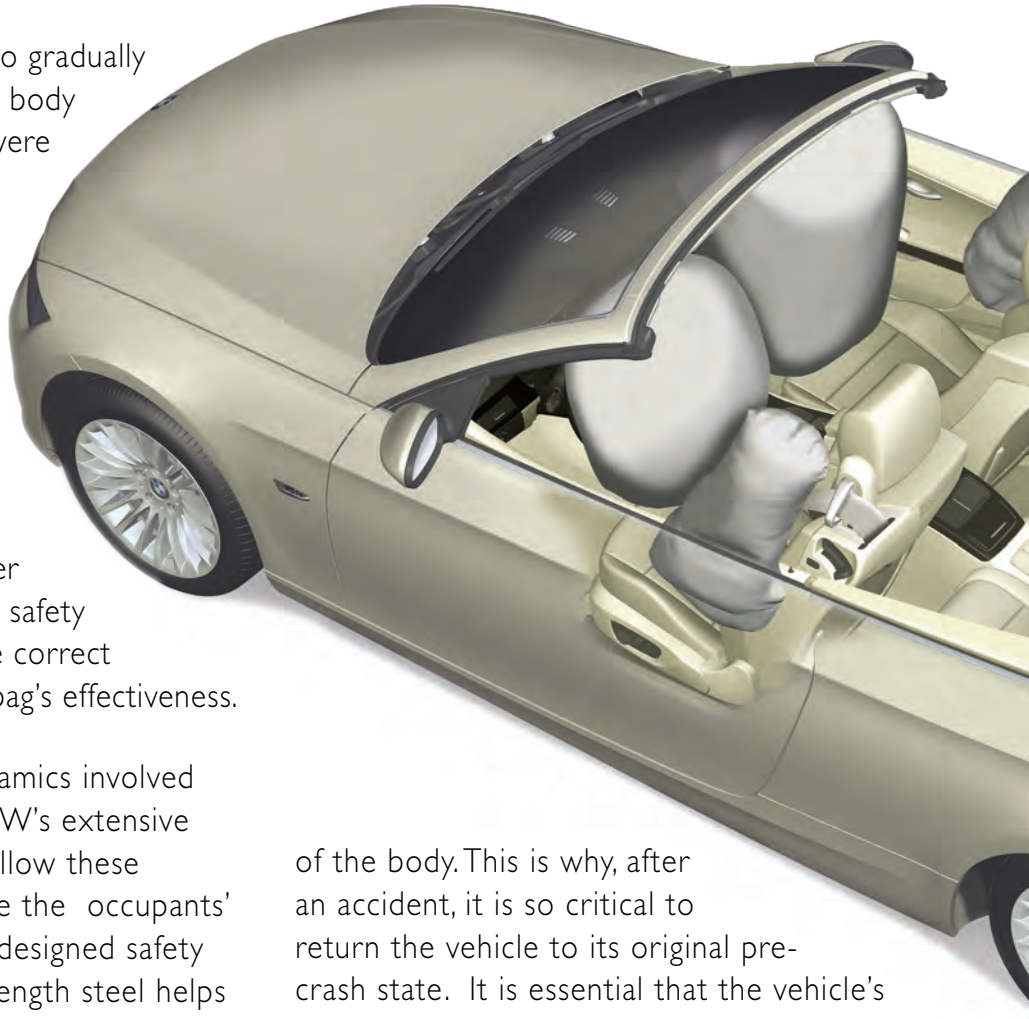
Cushioning the

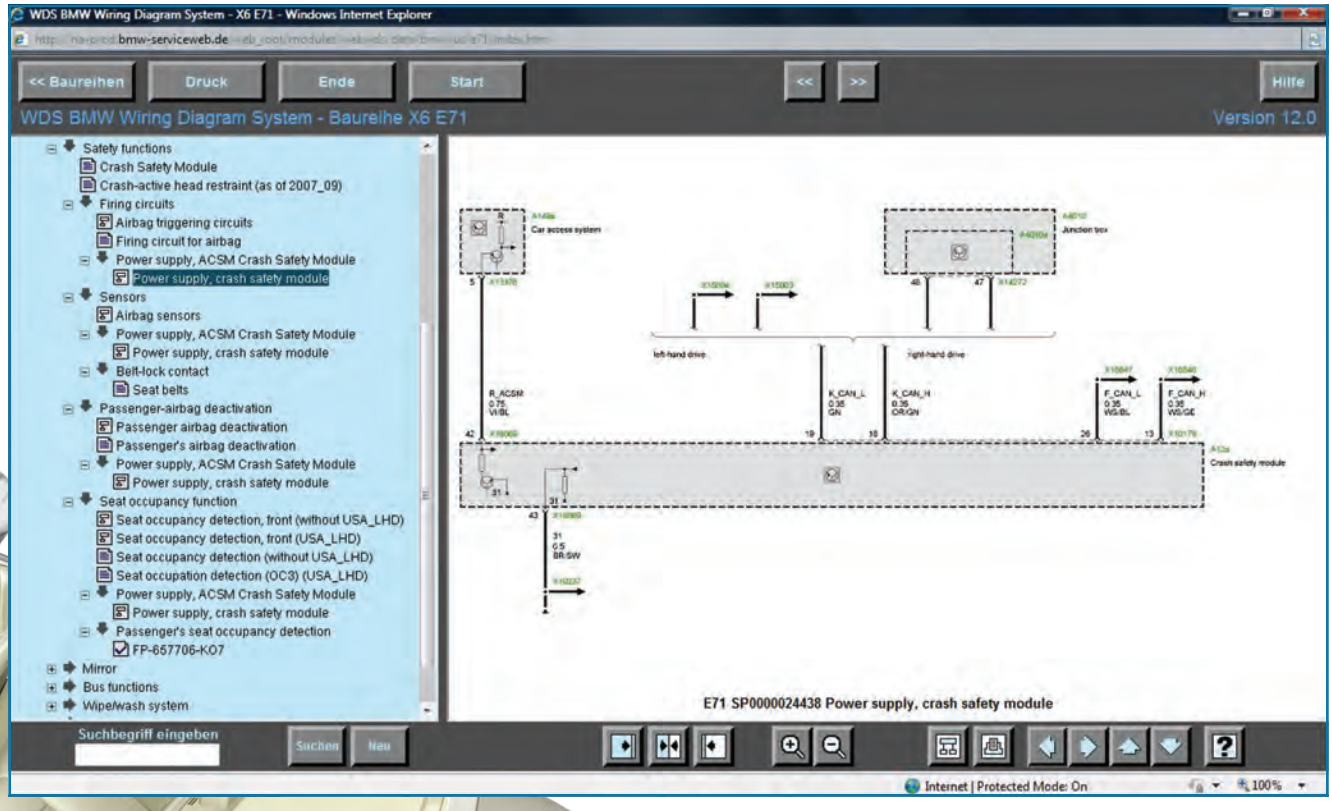
Among the greatest safety advancements are BMW's various types of supplemental restraint systems. Dual front air bags, side curtain safety bags and belt tensioning devices are only some of the life-saving features found on BMW vehicles. Here are some service procedures you should know about.



The purpose of an airbag is to gradually slow down the fragile human body after an impact. If an airbag were to deploy in front of you after your body had already moved forward, it would knock you backwards with significant force. It is supposed to fully deploy before your body has time to move forward, lessening the severity of the impact. Three-point seat and shoulder belts continue to be valuable safety devices. They keep you in the correct position to maximize the airbag's effectiveness.

The complexities of the dynamics involved in a crash are incredible. BMW's extensive research and development allow these restraint systems to minimize the occupants' injuries with these carefully-designed safety systems. In addition, high-strength steel helps maintain the cabin's shape, crumple zones absorb much of the energy of an accident, and airbags mitigate the rate of deceleration of the body. This is why, after an accident, it is so critical to return the vehicle to its original pre-crash state. It is essential that the vehicle's safety systems provide the same level of protection and after-collision performance as when it left the factory.

blow



With a paid subscription to www.bmwtechinfo.com you can access factory-level wiring diagrams. You can also retrieve component location, diagnostic information, and proper repair procedures to assist you during a repair.

Evolution, Not Revolution

Combination seat belt/shoulder harness assemblies have been standard equipment on BMWs for decades. In 1990, BMW added seat belt pre-tensioners. In a collision, an explosive charge (a mechanical system on the 3 series) tightens the seat belts in use to further restrain the occupant's movement inside the cabin.

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Driver's-side airbags have been around since the mid-'80s. Passenger's-side airbags have been used since the early '90s as well. In the mid-'90s, BMW started to implement seat-occupancy recognition systems, and the "intelligent" airbag system, also known as a dual-threshold deployment system. In less-severe collisions, or when a seat belt is not fastened, only one airbag will deploy. In a more severe crash both airbags are deployed simultaneously and offer better high-impact protection.

In 1996, door-mounted side airbags were added. These protect the occupants' bodies in the event of a side impact. BMW did not stop there. In 1997, BMW introduced HPS, the Head Protection System. Sometimes referred to as a curtain airbag, it protects an occupant's head in the event of a collision. Rear side airbags were also offered as an option then.

In 1997, the innovative BST, Battery Safety Terminal, cable was also introduced. This positive battery terminal has an explosive charge in it that disconnects the battery from the rest of the vehicle during a collision. This helps reduce the possibility of an electrical spark igniting any flammable liquids or other materials that might be present during an accident.

Dual-stage airbags were introduced in 1999. Here, a sensing system evaluates the severity of an impact and determines what combination of airbags will be deployed. With these and other advancements, today BMW no longer refers to these safety systems as airbags, SRS or SIR. They are now simply called MRS for Multiple Restraint Systems.

Roll Call

With all of this safety technology in BMW vehicles, it is important to know the new terminology in order to understand how to repair these systems. Let us look at the latest X6 E71 chassis as an example. The main brain in charge of the multiple restraint system is the ACSM (Advanced Crash Safety Module), which receives its power from the CAS (Car Access System). This ACSM is in total control of every airbag in the system and receives sensor inputs from impact sensors placed throughout the vehicle. It processes these signals and determines which airbags should fire and in what combination.

Aside from receiving inputs from impact sensors the ACSM also has two acceleration sensors itself. One sensor is used to detect the severity of a forward or rearward collision. The other acceleration sensor detects side impacts. This is important. Since the control unit can determine what direction the impact comes from, it can manage the more advanced system features that have been added to promote occupant safety.

(Left) As you can see in this photo, the impact sensor has sustained some water damage. Water was leaking into the cabin and collected under the driver's seat where the sensor is mounted. The impact sensor must be mounted properly in order to work correctly.

ORIGINAL BMW REMANUFAC

Series	Engine	Production Years	Models	Reman Part Number
E30	M42	Up to 04/1991	318i, 318is	64 52 8 385 916
E31	M62 M60	M60: 9/1993 - 11/19/95 M62: From 05/1995	840Ci, 840i	64 52 8 385 908
E32	M60	From 06/1992	740i, 740iL	64 52 8 385 908
E34	M60	From 01/1988	530i, 540i	64 52 8 385 908
E34	M50	Up to 07/1993	525i	64 52 8 385 915
E36	M50, M52, S52	Up to 09/1992	320i, 323i, 325i, 325is, 328i, M3	64 52 8 385 915
E36	S50	From 11/1993	M3	64 52 8 385 909
E38	M60, M62	Up to 09/1997	740i, 740iL	64 52 8 385 917
E38	M73, M73N	From 09/1997	750iL, 750iLP	64 52 6 911 348
E38	M73, M73N	04/1997 to 09/1997	750iL	64 52 2 147 456
E39	M52	Up to 09/1997	528i	64 52 8 385 919
E39	M62	Up to 09/1997	540i, 540iP	64 52 8 385 921
E46	M52, M54, M56, S54	M52, M54, M56: Up to 09/2002 S54: 09/1997 - 09/2002	320i, 323i, 323Ci, 325i, 325Ci, 325xi, 328i, 328Ci, 330i, 330xi, 330Ci, M3	64 52 6 911 340
E38, E39, E52	M62, S62	From 09/1997	740i, 740iL, 740iLP, 540i, 540iP, M5, ALPINA V8 Roadster, Z8 Roadster	64 52 6 911 342
E53	M62	From 10/1998	X5 4.4i / 4.6is	64 52 6 921 651
E53	M54	Up to 10/2002	X5 3.0i	64 52 6 921 650
E65, E66	N62, N62N, N73	Up to 4/2008	745i, 745iL, 750i, 750iL, 760i, 760iL	64 52 2 147 458
E60, E60N, E61	N52, N52N	Up to 9/2008	525i, 525xi, 528i, 528xi, 530i, 530xi	64 52 2 147 460
E46, E83	M54, M56, S54	From 09/2002	325i, 325Ci, 330Ci, M3, X3 2.5i / 3.0i	64 52 6 936 883
E60	M54	Up to 10/2005	525i, 525xi, 530i, 530xi	64 52 2 147 457
E60, E63, E64	N62, N62N	Up to 4/2008	545i, 550i, 645Ci, 650i	64 52 2 147 459
E82, E88	N51	Up to 3/2007	128i	64 52 2 151 495
E90, E90N, E91, E91N	N51, N52, N52N	Up to 10/2006	323i, 325i, 325xi, 328i, 328xi, 330i, 330xi	64 52 2 151 495
E92	N51, N52N	N51: Up to 3/2007 N52N: Up to 10/2006	328i, 328xi	64 52 2 151 495
E93	N51	Up to 3/2007	328i	64 52 2 151 495

TURED A/C COMPRESSORS

Series	Engine	Production Years	Models	Reman Part Number
E82, E88	N54	From 11/2006	135i	64 52 2 151 496
E90	N54	From 3/2006	335i, 335xi	64 52 2 151 496
E90N	N54	From 04/2008	335i, 335xi	64 52 2 151 496
E92	N54	From 06/2005	335i, 335xi	64 52 2 151 496
E93	N54	From 10/2005	335i	64 52 2 151 496
E82	N51, N52N	N51: From 03/2007, N52N: From 10/2006	128i	64 52 2 153 227
E88	N51, N52N	N51: From 03/2007, N52N: From 10/2006	128i	64 52 2 153 227
E90	N51, N52, N52N	N51: From 03/2007 N52, N52N: From 10/2006	323i, 325i, 325xi, 328i, 328xi, 330i, 330xi	64 52 2 153 227
E90N	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i, 328xi	64 52 2 153 227
E91	N52, N52N	From 10/2006	325xi 328i	64 52 2 153 227
E91N	N52N	From 10/2006	328i, 328xi	64 52 2 153 227
E92	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i, 328xi	64 52 2 153 227
E93	N51, N52N	N51: From 03/2007 N52N: From 10/2006	328i	64 52 2 153 227

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On this same E71 chassis, the ASCM has a total of eight impact sensors. The two front impact sensors are mounted just outboard of the radiator on both sides of the front side of the frame. There are two door impact sensors that mount in each door near the door handle. In addition, there are sensor assemblies mounted in the B pillar on each side of the vehicle. Each of these sensor assemblies has two sensors in it. The pillar-mounted impact sensor must be replaced as an assembly, so there are six serviceable impact sensors. This gives us a total of six external sensors and one ACSM that are serviceable components.

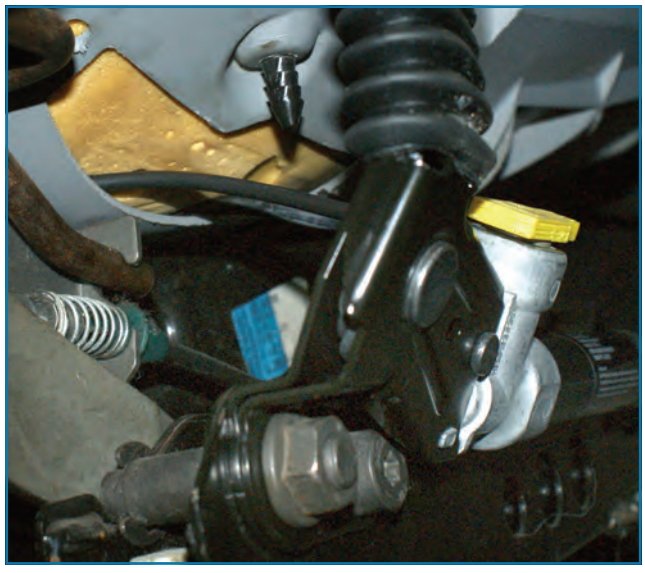
The E71 also has a total of eight airbags. The driver's and passenger's airbags are both dual-stage. They will need to be replaced as assemblies. There are two knee bolster-mounted airbags to protect the driver's and passenger's knees. The two side airbags are mounted in their respective seats. Two curtain airbags for the Head Protection System (HPS) are mounted on each side of the roof just above the doors.

Airbags are not the only components activated in an accident on the new X6. There are also four front seat belt pre-tensioners. Two are mounted on each front seat belt. One is on the buckle side and the other is on the belt side mounted in the B pillar. There are also two seat belt pre-tensioners mounted on each side of the rear seat belt buckles. What is relatively new here is the Active Head Restraint system. This deploys the headrest forward to reduce the distance between an occupant's head and the headrest in rear-end collisions. Finally, we have the BST cable mounted on the positive terminal of the battery. This gives us a total of 17 serviceable igniting components in the MRS.

When replacing deployed components, it is always best to use only new components from your BMW parts supplier. Used components can expose you to liability issues if they fail to function properly in future accidents.

The ACSM has some additional inputs other than those from the crash sensors. The seat belt buckles have switches to indicate if they are latched. There is a switch that is discretely wired to the ACSM to turn on and off the passenger side airbags. There are also both driver's and passenger's side seat occupancy sensors mounted in the seat cushions. These sensors detect the approximate size of the occupants and their signals are used to calculate airbag deployment rates.

Modern BMW computer controls incorporate self-diagnostics to assist in troubleshooting, especially when dealing with airbag systems. BMW does not recommend using any electrical test equipment to test wiring or components, and strongly recommends that you use the self-diagnostic features of the BMW factory scan tool. You can use the ISTA feature on the BMW technical information website with an appropriate



When replacing any airbag component, it is very important to duplicate the existing harness routing. Here we have the pre-tensioner wiring routed between the seat cushion and the plastic cushion support. This positioning ensures that the wiring is not caught on the seat adjustment track and damaged.

BMW ICOM interface, or approved passthrough device as your diagnostic tool. For more information on these procedures, take a look at www.bmwtechinfo.com "Online Service System."

Repair Procedures

Of course, when dealing with any airbag system you should take all necessary precautions in order to prevent injury. The system should only be serviced with the key in the "0" position. The battery must be disconnected and you should wait at least a full minute before disconnecting any impact sensors or airbags from the vehicle. The BST cable kills power to the vehicle during an accident, but the ACSM has capacitors that continue to supply power to the control unit even after the battery is disconnected. This is why you must wait one minute before you start any service work on the vehicle.

Obviously, you will need to replace any deployed airbags. That is clear. What may not be clear is if the Active Head Restraint system has been deployed. Also, the seat belt pre-tensioners may need to be replaced even if the accident was not severe enough to deploy the airbags. For particular models, the means of finding out if these units must be replaced can be found at www.bmwtechinfo.com.

The ACSM is capable of recording vehicle information during a crash, similar to a "black box" in an airliner. This information can be retrieved for the purposes of an investigation or insurance claim. The unit can record and retain information for up to three accidents. After that, the memory is full and cannot be cleared so the ACSM must be replaced. The ACSM is coded specifically to each individual vehicle, so the replacement will also need to be coded.

When you are performing repair work on the vehicle, you are expected to unplug the ACSM before unplugging any additional components. Within the ACSM connector are shorting bars that bridge all of the wiring together to prevent any accidental firings. If welding is involved, you should also remove all possible ignition devices in order to prevent any accidental deployment during the repair.

Winding Up

BMW's reputation for safety is impressive. After a collision, the BMW owner expects the vehicle to be returned to its pre-crash performance capabilities. Not just cosmetically, but also in terms of crashworthiness. It is essential that you use the proper tools, parts, and procedures to assure that all safety systems will perform as designed. These same procedures will also help prevent injury during repair. ●

You may now be seated

As far back as the early nineties, BMW offered memory seating, marking a new application for electronic control units. While these systems have become more complex, service procedures remain straightforward.

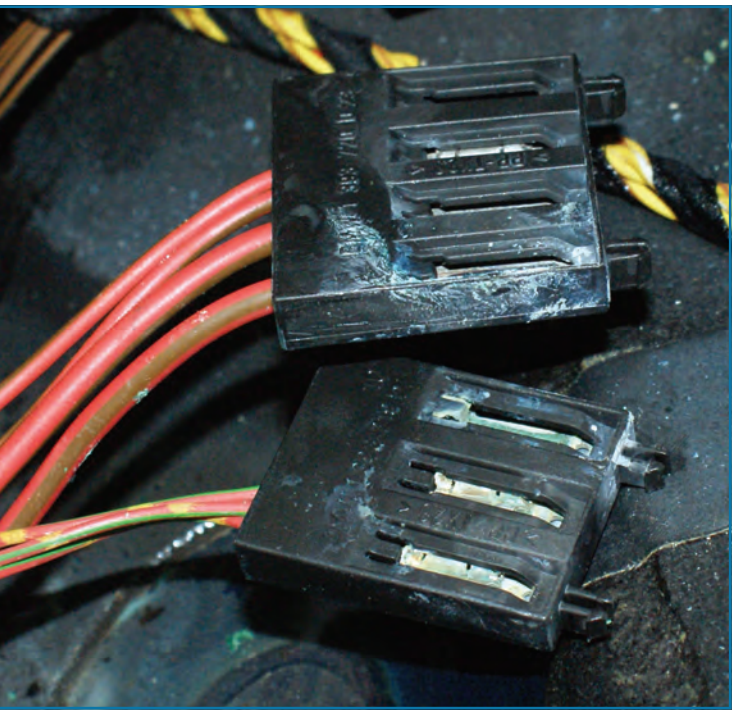
Power seats have been around for decades. In early applications, a simple set of switches provided power and ground to DC electric motors. Today's memory seating, however, requires some sophisticated electronics.

Who's In Charge?

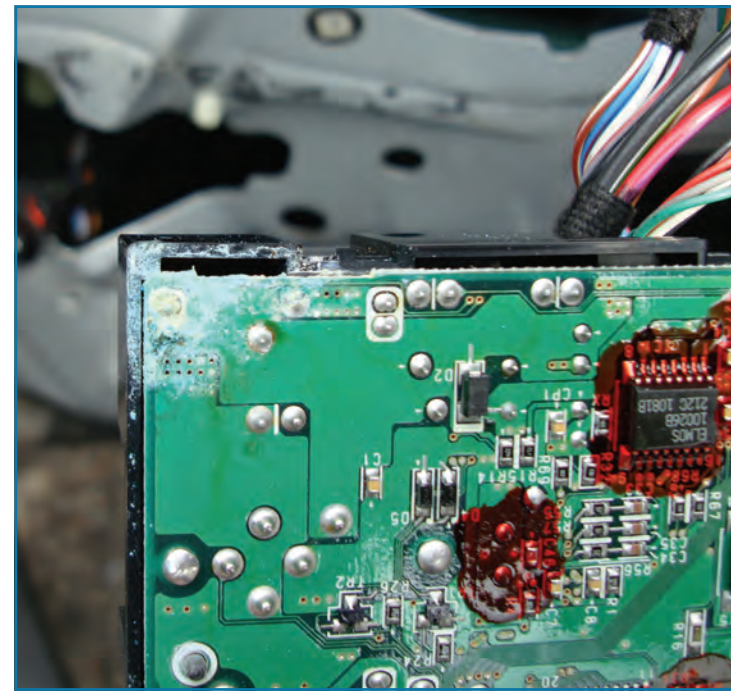
In the early '90s, BMWs were equipped with manual or electric power seats. Higher-end models such as the 7 Series had memory seats as an option. This required a control unit to make the necessary logic decisions, and BMW opted for a combination Seat/Steering Column Memory Control Module (SM/LSM) to perform this function on early- to mid-'90s vehicles. However, it is not the only module controlling memory functions.

There is a matrix of modules working in concert to control the movement of the side-view mirrors, steering column and, of course, power seats. The SM/LSM controls the memory functions for the seats and the steering wheel. The power mirror memory functions are stored in their respective door modules.

The memory switch input is wired to the driver's door module. The modules communicate the memory selection via a P-Bus to the SM/LSM. The door modules and SM/LSM operate the various motors to move them into their set positions. The motors are solid-state controlled. They have a power supply, a ground and a single control wire that carries a square-wave signal from the SM/LSM. This signal positions the motor. You can use a scope or graphing multimeter to monitor the signal.



You may have checked fuses, but that does not mean adequate voltage has made it to the control unit and seat motor. On this E38 chassis, the power distribution point for the motors (the R/Br wire) has been immersed in water and corrosion has created a voltage supply problem.



Sometimes the first step in the diagnosis is the most critical. If the power seats are working fine, but power mirrors and other memory functions are not, remember that the switch signals may pass through a door control module. This one shows signs of water damage.

Evolution Of The Breed

Fast forward to the E46 chassis and you find the more things change the more they stay the same. Control units still control most memory features, but there are now two modules. One is the Driver's Seat Memory Control Module, and the other is for the passenger side, and they are essentially identical. If replacement is required, you do not have to code for the driver's or passenger's side application. Harness pin #13 will inform the Seat Memory Control Module if it is mounted on the driver's or passenger's side. On the passenger's side, pin 13 is grounded; on the driver's side it's left open. If the wire in pin 13 on the passenger's side were broken, the circuit would be open and the K-Bus line would not be able to differentiate between the driver's and passenger's seat. As a result, neither seat may operate as designed.

Some BMW Cabriolet models are equipped with the Easy Entry feature. You can determine if a vehicle has this option by looking at the seat back lock handle near the top of the backrest. A switch in the handle commands the driver's seat module to move the seat rearward and the steering column up to make entry easier.

If this feature is not functioning, check the driver's seat control module with your scan tool and monitor the lock handle switch input. If this is okay, there are still two other signals required for the feature to work. The vehicle speed input

While you may think the GEM (General Module) has a lot to do with interior electrical functions, it does not control the seats. It does, however, monitor the diagnostic functions for the K-Bus. You should scan the GEM for codes when having problems with power seating systems.

can interrupt the Easy Entry feature. But this is not a likely cause when the engine is not running and the vehicle is not moving.

The last input is the driver's side door switch. If this switch is not indicating the door is open, then the feature will not work. The driver's door switch input is wired directly to the GEM (General Module). Through the K-Bus, the driver's door signal is passed on to the driver's seat module. With an iComm or aftermarket equivalent scan tool, you can monitor the door switch input both in the GEM and the driver's seat module.

Who is Protecting Whom?

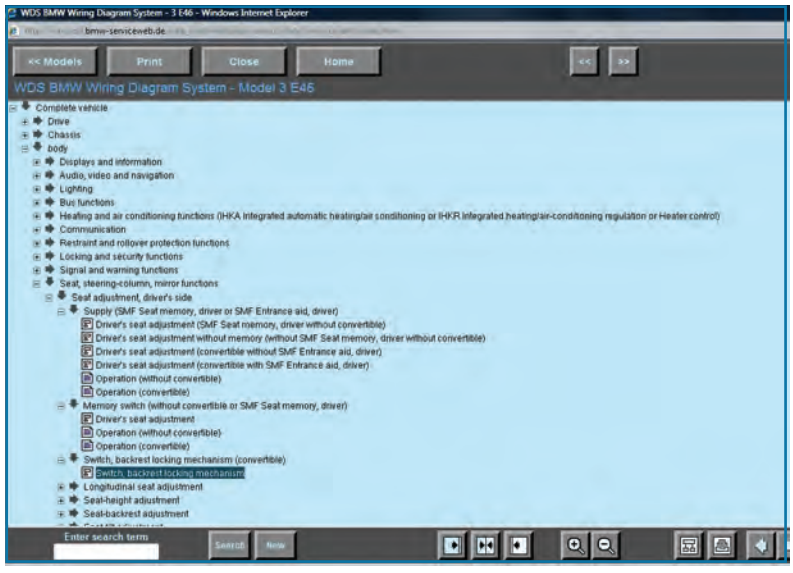
Some car owners keep their vehicles very neat and clean. Others not so much. Throw a child seat in the back and there is a good chance that a toy or something similar can end up on the floor behind the driver's or passenger's seats. If this object limits seat movement, you can easily damage something in the power seat system.

BMW seat modules monitor amp draw and either motor ripple counts, or a Hall-effect sensor, to determine the seat's position. The forward and rearward (or up and down) stops are recorded. If the applied motor were to jam, the amp draw of the motor would increase. The seat module will remember this event as an end stop. Even after the object is removed the end stop will remain. To reset an end stop, you simply continue to operate the button in that direction. The motor will continue moving in that direction in short increments until you have reached the actual end stop. At this point, the retrieved end stop is stored and normal function should resume. If not, you may have a bad seat motor.

In other cases the motor may be fine, but the position sensor (ripple counter) may not be functioning. On early 2000 models, you do not have direct access to the position signal. It is transferred through serial data communication between the seat motor (w/ solid state module) and the seat control unit. A scan tool with factory capabilities is necessary to monitor this data directly.

Testing, Testing, Testing . . .

While an iComm or aftermarket equivalent scan tool is helpful in diagnosing complex bus communication problems, simpler problems can be handled with a DMM (Digital Multi-Meter). We have noticed that the fuses are either the first or the last things checked



While selecting the proper wiring diagram for a particular vehicle you will see in the navigation function that there may be many variants for a given system. Aftermarket information systems may not show all of these variations. A paid subscription to ***www.bmwtechinfo.com*** *will give you all the information you need.*

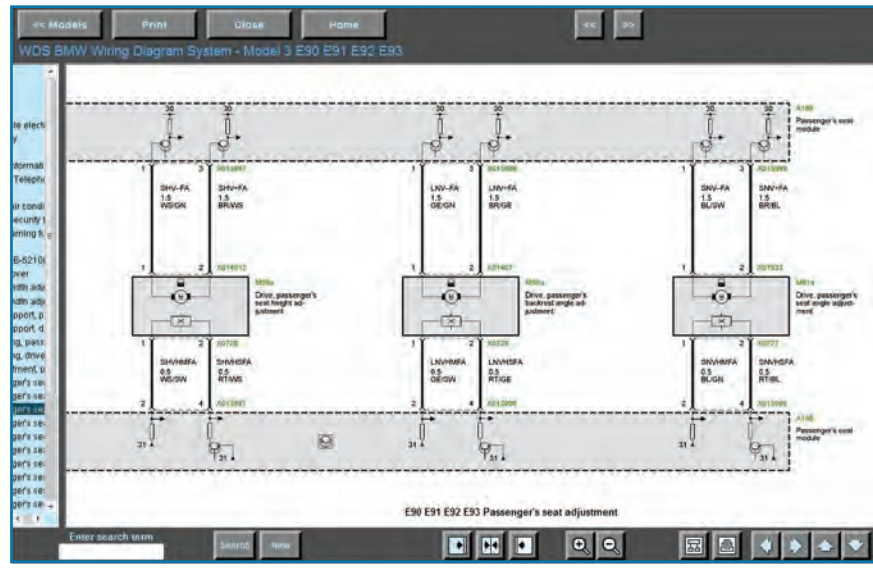
when diagnosing a problem. Aside from the simple blown fuse or data communication line problem, you can still check power feeds, grounds, and switch inputs without special tools.

Memory seats use control units to carry out the necessary functions. Every computer system needs inputs and outputs. Although we know that there are inputs coming in from the K-Bus network, there are still other signals from the various switches and output controls sent directly to the motors. The key to efficient troubleshooting is knowing what to look for.

An accurate wiring diagram is essential to a repair. Aftermarket information systems are often incomplete, and may not account for the variants of a system. There are two-door models, four-door models, wagons, and convertibles. In addition, there are standard features, and other advanced integrated features that are optional. This means that there is a possibility that a given vehicle may have eight or more different wiring diagrams, with the possibility of additional changes being made during a production run. With a paid subscription to www.bmwtechinfo.com you will have access to accurate wiring diagrams that cover all the variations involved in the system. Obviously, memory seats require inputs to an on-board computer. This means you are not just dealing with 12-volt switches providing power to a motor anymore. You may have a five-volt reference that, when pulled to ground, tells the control unit to energize the motor, and there has to be a switched input for each possible direction the motor can move in.

Switches and resistors can be engineered using something called "resistive multiplexing." In this configuration a reference voltage comes from one wire. Wires can pass through two separate resistors depending on which way the circuit is designed. One resistor drops the reference to one specific voltage, while the other resistor drops the voltage to another specific voltage on the same wire. Each individual voltage tells the control unit to perform a different function. This way one wire can carry two different signals. This cuts the amount of wiring in a system in half, reducing

This wiring diagram shows that on the late-model 3 Series there is a control unit that manages the seat motors. The wiring is fairly straightforward. There are power supplies and a grounds you can test. There are also two wires to test for the position signal voltage.



both weight and complexity. Check your switch inputs with a DMM. On the same wire you will see two different voltages depending on the switch position.

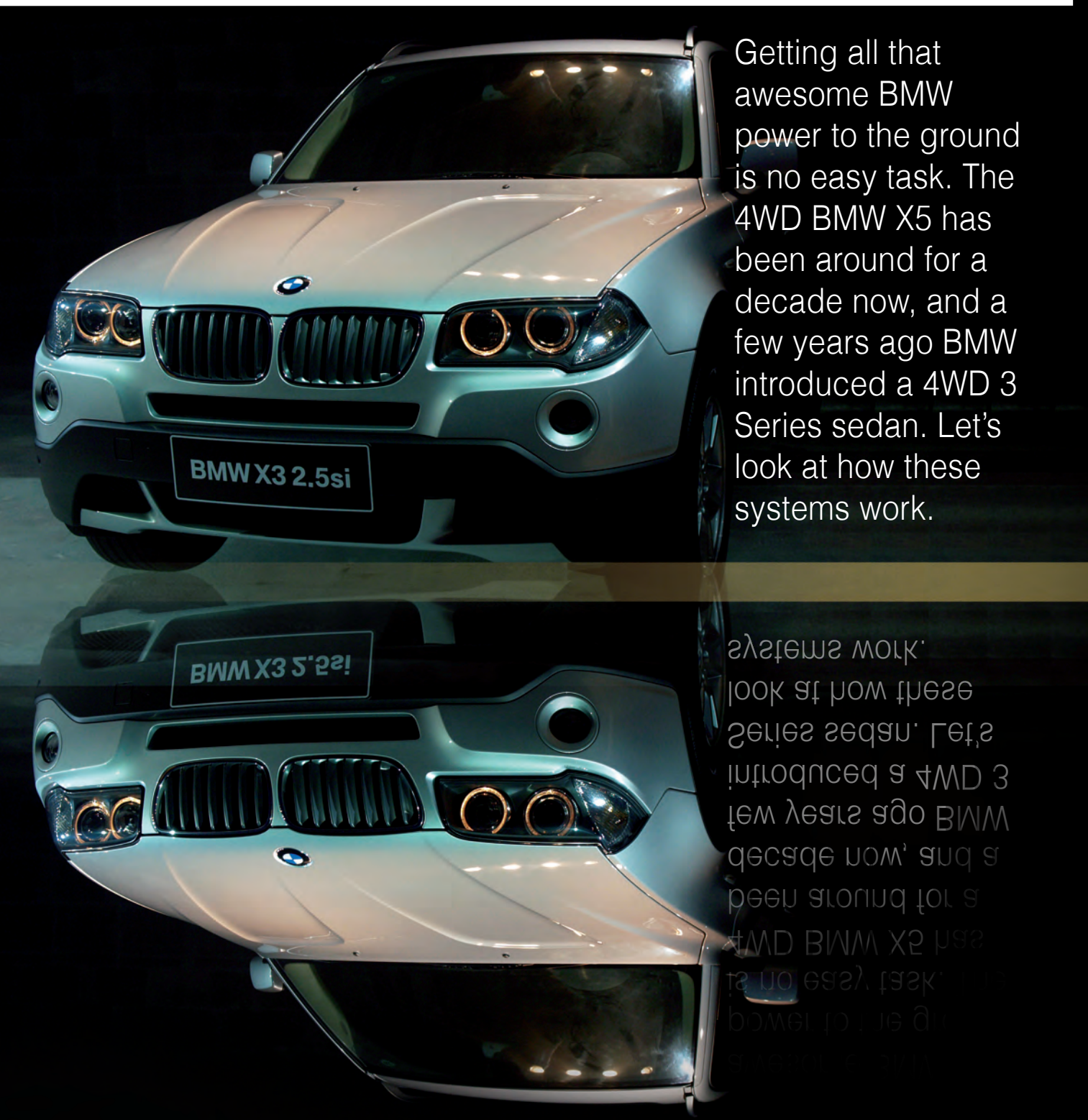
When it comes to power seat motor outputs, diagnosis is pretty simple. One wire carries the supply voltage and the other carries the ground. A control unit can easily alternate between 12 volts and ground on a single wire. That means it only takes two wires to control a motor. By connecting your DMM between these two wires you will see either +12V or -12V depending on the polarity of the motor. In BMWs, a small control unit mounted inside the motor assembly provides the necessary power and ground according to needs. This control unit is supplied with a 12-volt power feed and a ground so it has everything it needs to work with. You can easily check this power supply and ground circuit with a DMM.

What is less clear is how to determine the signal from the memory seat control module to the control unit on the motor. Although it's not as definitive as scan tool data, you may be able to analyze the signal wire with an oscilloscope or a graphing multimeter. You should see square-wave patterns. As a command is sent, you should look carefully to see if the patterns change. Any change at least shows that a command is being sent. Clearly, this is not an ideal situation, but when scan data is not available this is all we have to work with. With the BMW website and a passthrough tool for programming, BMW makes iComm diagnosis programming and software available to you on your laptop. This is an excellent way to get access to factory scan data at a reasonable price.

Finally

BMW offers many different features on its vehicles that necessarily bring with them a certain level of complexity. When troubleshooting, you'll need to sift through that complexity, interpret the wiring diagrams and implement a logical diagnostic plan. This will help increase the speed and cost-effectiveness of repairs and provide excellent customer satisfaction. ●

Power Distribution



Getting all that awesome BMW power to the ground is no easy task. The 4WD BMW X5 has been around for a decade now, and a few years ago BMW introduced a 4WD 3 Series sedan. Let's look at how these systems work.

The E30 chassis was the first to sport four-wheel-drive here in America, and the original X5 (E53 chassis) was released in 2000 with a 4.4L V8 that produced 282 horsepower. In 2002, the 4.6L M62TU was added, which brought the horsepower up to 340, and this trend has continued.

So, how is all this horsepower translated into acceleration without simply burning up the tires? The logical answer is through 4WD, which feature has grown in numbers at BMW. In 2001, the E46 chassis 325xi Sport wagon and the 325xi and 330xi sedans received the 4WD treatment. In 2004, the new xDrive system was introduced in the X3 (E83 chassis), and in 2006 the 5 series E60 (Sedan) and E61 (Wagon) chassis were offered with the xDrive system. That is quite an extensive offering of 4WD vehicles, and more have been added every production year. Of course, besides harnessing huge amounts of horsepower on pavement, this feature keeps you going in snow, or off-road, and improves weight distribution and stability control.

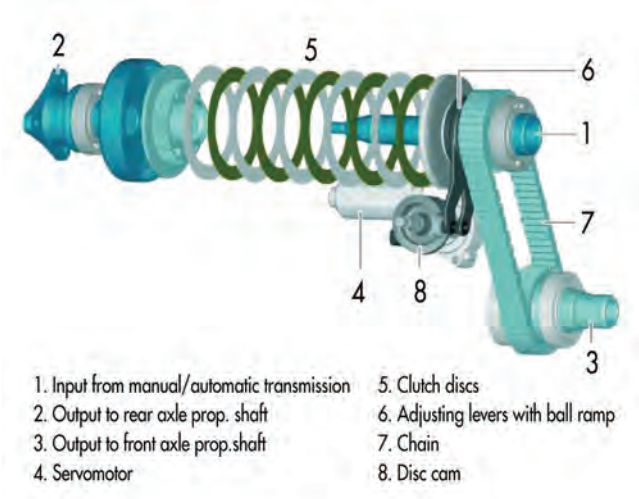
The X5 in particular was designed to handle well in on-road and off-road situations. There are many technological advancements that come standard on the X5. ABS (Antilock Braking System) and ASR (Anti-Slip Regulation) are standard, with DSC (Dynamic Stability Control) available as an option. All of these systems are specifically tailored to the E53 chassis. They also work with the newer BMW xDrive system. The combination of these various systems helps enhance traction and improve vehicle control. Now it's our job to maintain their performance.

Sometimes a physical inspection is all you need to identify the transfer case model. Look at the top line and you can see this is a New Process NV125. This means it has a planetary gearset that is full-time 4WD, and a 32% front/68% rear torque split.

How does 4WD work?

The first transfer case used in 4WD BMWs was the New Process NV125 unit. The main component of the NV125 is the planetary gear set. This is what divides the torque to the front and rear differentials.

Here's how it works: The transmission output shaft drives the entire planetary carrier, which provides a 68% rear/32% front torque split between the drive shafts. An annulus gear driven by the carrier directs power to the rear drive shaft. Sun gears in the planetary gearset transmit torque to a drive chain that then drives the front axle drive shaft. This is a very strong design that is usually trouble-free. A key benefit is the ability to split torque under varying conditions thanks to the ADB (Automatic Differential Brake). When the DSC control unit senses a loss of traction based on input from the wheel speed sensors, the brakes are pulsed on the wheel



Here are the key components of the ATC transfer case. The input shaft directly drives the rear output shaft. The servo motor can engage or disengage the clutch that drives the front axle. This VTG system has a control unit with self-diagnostic capability.

that is spinning. This pulsed braking directs more torque to the other wheel on the same axle. If both wheels on the same axle indicate a loss of traction, the DSC module applies hydraulic pressure to both wheels so that torque flows only to the other axle. This original system is simple and sturdy.

In the '04 model year a variation of the original 4WD system was introduced. It was called xDrive and included VTG. The new transfer case is the ATC 400 for the M54 engines and ATC 500 for the M62. This new system added a multiple-plate clutch instead of a planetary gearset to drive the front axle off of the permanently-connected rear drive shaft. An electric servo motor controls the application of the clutch pack to drive the front wheels.

When the clutch pack is completely disengaged, no torque is applied to the front wheels. With the clutch pack fully engaged, the torque is split evenly between both axles so they travel at the same speed. Under normal dry weather acceleration, more torque is directed towards the rear axle. If the rear axle loses traction, the servo motor progressively engages the clutch pack and directs more torque towards the front axle. The DSC system can still apply the brakes to any wheel that's spinning and direct more torque to the opposite wheel. Remember that ABS and traction control systems are still active even when the DSC is shut off.

What Controls the Servo?

For newer vehicles, BMW engineered a Transfer Case Control Unit (VGSG) to control servo operation and installed it on the PT CAN bus. From the PT CAN, the

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BMW vehicles are engineered to decelerate outstandingly from Autobahn speeds, so their brakes are right up there with the best in the world. Following the correct service policies and procedures will help maintain performance and make this work more profitable.

Questions/Comments?
Contact: Christopher M. Ayers Jr.
Publisher
Email: cayers@thebimmerpub.com

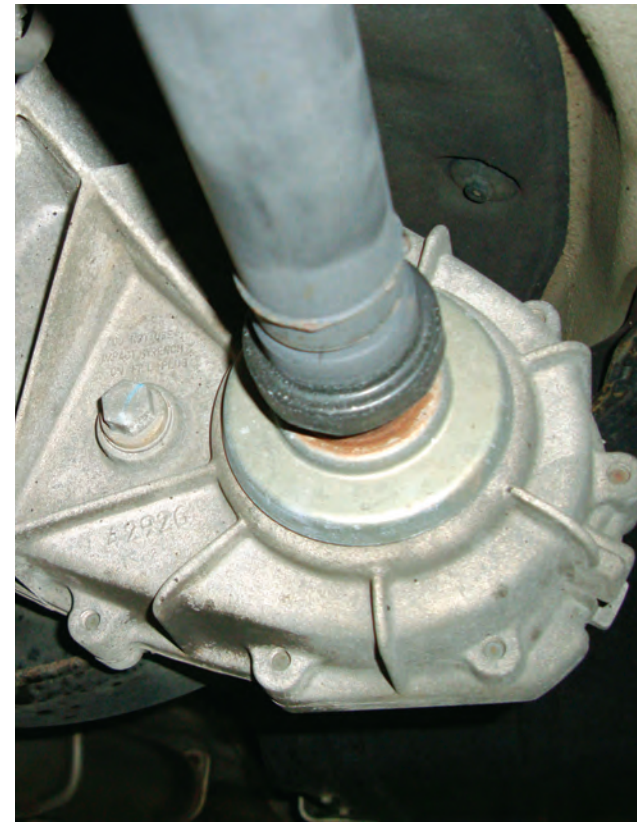
VGSG monitors accelerator pedal position, engine load, wheel speed sensors, and other parameters. Under normal conditions torque is divided 40% to the front axle and 60% to the rear. When the VGSG unit senses wheel slip, it directs the servo motor to apply or release the transfer case clutch pack. Since it is a servo controlled clutch, the VSCG unit can adjust the torque division in very fine increments.

To monitor the position of the clutch pack the VGSG reads the signal from a hall-effect sensor built into the servo motor. To compensate for age and wear, the servo is cycled every time the ignition key is turned off. The VGSG unit monitors the amperage draw of the motor to calculate the full-open and full-closed position of the clutch packs With the stop points determined, the VGSG next looks at the Hall-effect signal. As the clutches wear, the number of Hall-effect signals increases. If a problem is detected during this process, the appropriate code will be set and a fail-safe mode may be activated.

Lubrication is Critical

In addition to controlling servo operation, the VGSG unit also monitors transfer case fluid condition and signals when the oil needs to be replaced. Since driving habits vary from one driver to another, there is no set service interval for the transfer case oil. The level should be visually checked every 30,000 miles. This can be done by removing the fill plug on the front side of the transfer case with the vehicle level, and reaching in with a finger to confirm that the fluid level is flush with the hole.

A code 54C6 in the VTC system indicates that the oil needs to be replaced. On the older NV124/5 transfer cases (w/o servo motor), Dexron III is the proper lubricant. The E46 chassis with 4WD has its own fluid, MTF-LT-1 and MTF-LT-2. On the E53 and E83 chassis with the xDrive transfer case (w/ servo motor) produced before February of 2005, use a Shell Gear oil part #83 22 0 306 816. All models built after February of 2005, such as the E60, E61 and E90 chassis, use a proprietary BMW fluid TF0870 part #83 22 0 397 244. Part numbers do get updated, so the best way to ensure you are getting the correct fluid is to give the BMW dealer's parts personnel the last eight digits of the VIN



After draining the transfer case (the drain plug is under the ID tag in the first photograph), you can refill the system here. The choice of lubricant for the transfer case is critical. Be certain to use the specified oil, which is available from your BMW parts supplier.

Notice the drain plug at the bottom of the front differential and the fill plug above it and just above the frame rail. On this E46 chassis with 4WD, you need SAF-XJ gear oil for the viscous lock-type differential. It has the necessary additives to prevent clutch chatter. Make sure to shake the bottle thoroughly, which will evenly distribute the additives before refilling.

to properly identify the vehicle, and also the transfer case model, then purchase the oil.

And Now, the Rest of the Story

A 4WD system is more than just a transfer case. The front and rear drive shafts can cause vibration if they're bent or out of balance. These drive shafts feed power to the front and rear differentials through CV joints that operate under very close tolerances. If you must remove a drive shaft, be careful not to allow the CV joint to come apart as it will be extremely difficult to reassemble without creating a driveline vibration.

The front and rear differentials should be inspected regularly. In particular, you should look for leaks, and check fluid level and bearing end play. To properly service one of these differentials, you must know if it is a limited-slip (rear differential), or a viscous-lock differential as used in the front axle of the E46. Just as you've done with domestic vehicles for decades, you can tell if you have a limited slip differential by spinning one wheel with the transmission in neutral. If the other tire on the same axle spins in the opposite direction, you have a conventional, or "open" differential. If it spins in the same direction, you have a limited-slip differential.

Limited-slip and viscous-lock differentials require the specific fluid SAF-XJ. You can use SAF-XO fluid in conventional differentials. Incidentally, since the introduction of synthetic gear oil, BMW now recommends that you replace any existing fluid with synthetic fluid

Carefully check the front drive shafts on 3 Series 4WD vehicles. If a half shaft or CV bearing is worn or damaged, it can also do damage to the front differential bearing and wheel bearing it is attached to. If a customer ignores a driveline vibration, he or she could end up with a very costly repair.

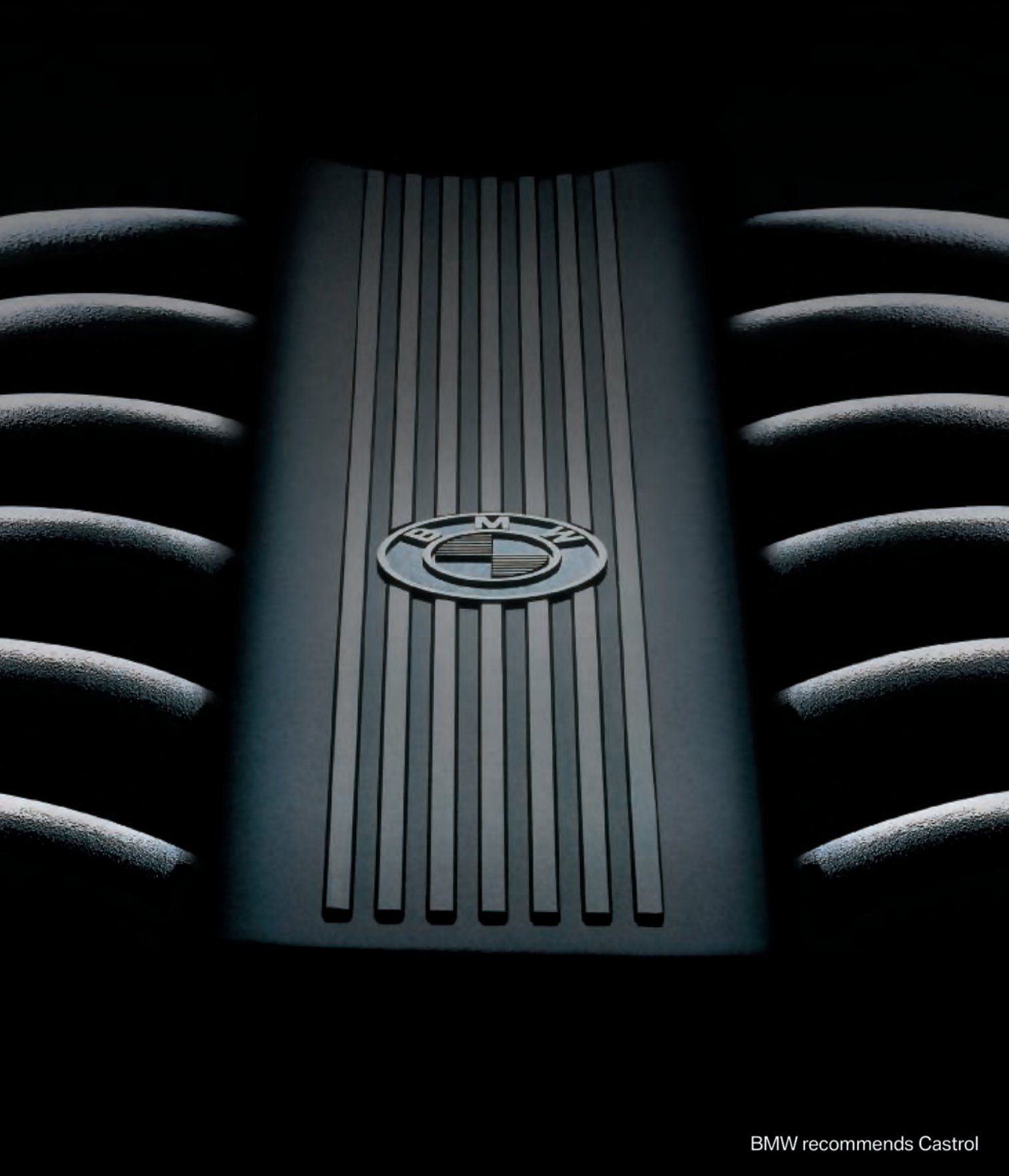
for all models. Your BMW parts supplier can provide you with the correct fluids for your customers' vehicles. And never use conventional gear oil in limited-slip or viscous-lock differentials since they will chatter in tight turns and eventually fail.

BMW has always used fully independent suspensions with drive axles and CV joints. During inspection, check wheel bearing end play, and CV joints for excessive play as well as seized or worn components. A ripped or torn boot will allow dirt into the inner and outer constant velocity joints and wear out the bearing prematurely. Many in the industry say that just eight hours of driving with a torn or broken CV joint boot will result in irreparable damage to the joint.

On the E46 chassis in particular, pay close attention to the front axles to assure that the CV joints are not binding. And it's never a good idea to run the drivetrain while the vehicle is on a lift and the wheels are hanging, especially at speed. The angle between the CV joint and the axle shaft will be too great and can cause excessive wear and/or damage to the CV joint.

In Conclusion

Whether you are simply changing the fluid of a NV124/5 gear box, or pulling codes on the ATC 400/500, knowing what is involved in servicing and maintaining these 4WD systems can be simple and profitable. Your BMW parts supplier can help you achieve this by providing you with factory OEM parts and fluids designed specifically for every BMW you service. ●



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